Bo Shang, Ph.D.

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Postdoctoral Scholar at Civil Engineering, Grove School of Engineering, CUNY City College
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Experience

- **AI & Mobility Research Lab, CUNY City College** *July 2025 - Present*
  Postdoctoral Scholar New York, NY, USA
  - Leading research on AI-powered traffic monitoring and LiDAR-based object detection
  - Developing multimodal sensing frameworks for intelligent mobility and infrastructure safety
- **Civil Engineering, CCNY** *Jan 2025 - June 2025*
  Graduate Research Assistant New York, NY, USA
  - Conducted research on transportation systems and AI applications
- **CCNY Robotics Lab** *Dec 2022 - Dec 2024*
  Post-Doc Researcher New York, NY, USA
  - Developed automated bridge inspection systems integrating AI, cloud technologies, and robotics
  - Engineered CNNs for structural damage detection and deployed models on AWS cloud
- **Vaughn College** *Jun 2024 - Aug 2024*
  Instructor, Computer Engineering Summer Academy (AI module) New York, NY, USA
  - Taught AI concepts and applications in computer engineering summer program
- **Vaughn College of Aeronautics and Technology** *Jan 2024 - May 2024*
  Adjunct Faculty New York, NY, USA
  - Taught courses in robotics, mechanics, control, and AI principles
- **CUNY City College** *Aug 2023 - Dec 2023*
  Adjunct Assistant Professor New York, NY, USA
  - Taught Electric Circuits (ENGR 204)
- **Missouri University of Science and Technology** *Jan 2020 - Nov 2022*
  Post Doctoral Fellow Missouri, USA
  - Developed advanced drone systems with robotic arms for automated bridge inspections
  - Created vision-based control systems for UAV guidance and bridge inspection
- **University of California, Merced** *Jan 2016 - Aug 2017*
  Lecturer Merced, CA, USA
  - Teaching Assistant for Mechatronics, Engineering Computing (Fortran and MATLAB), and Unmanned Aerial Systems
  - Initial Designer of laboratories for Unmanned Aerial Systems course
- **University of California, Merced** *Aug 2015 - Sep 2017*
  Junior Specialist Merced, CA, USA
  - Conducted research on unmanned aerial systems and robotics

Education

- **City College of New York (CCNY)** *2025 - Present*
  Ph.D., Civil Engineering (Transportation) New York, NY, USA
- **Northeastern University** *2013 - 2020*
  Ph.D., Pattern Recognition and Intelligent Systems China
- **University of California, Merced** *2015 - 2017*
  Exchange Ph.D. Student Merced, CA, USA
- **Northeastern University** *2011 - 2013*
  M.E., Pattern Recognition and Intelligent Systems China
  - GPA: 3.53/4.00
- **Northeastern University** *2007 - 2011*
  B.E., Automation China
  - GPA: 3.42-3.74/4.00

PROJECTS

- **Traffic Monitoring using Fixed LiDAR** *Nov 2024 - Present*

  Tools: Python, Computer Vision, CNN, LiDAR Processing, Deep Learning

  ◦ Developing an end-to-end pipeline for traffic monitoring with fixed LiDAR systems, including background subtraction, object segmentation, and detection

  ◦ Working on multi-frame vehicle reconstruction to generate individual vehicle models and classify moving objects such as vehicles, motorcycles, bicycles, and pedestrians

  ◦ Evaluating various CNN-based networks for object detection from LiDAR traffic data

  ◦ Designing a flexible mechanism that enables training on one dataset and inference on another, even with different configurations

- **Advanced Bridge Inspection Automation System** *Dec 2022 - Present*

  Tools: Python, CNN, AWS Cloud, WebODM, iOS Development, Computer Vision, Robotics

  ◦ Spearheaded the development of a comprehensive automated system for bridge inspection, integrating cutting-edge AI, cloud technologies, and robotics

  ◦ Engineered and trained sophisticated CNNs for precise detection of structural damages, including cracks, spalling, and stains

  ◦ Successfully deployed AI models on AWS cloud, ensuring scalability and high-performance processing of inspection data

  ◦ Designed and implemented a custom WebODM-based platform that streamlines the entire inspection workflow, including automated damage segmentation, 3D reconstruction, interactive visualization, and precise measurement of cracks

  ◦ Developed a handy iOS application to control and operate a specialized climbing robot, enhancing the reach and efficiency of bridge inspections

- **Bridge Inspection Robot Deployment System (BIRDS)** *2020 - 2022*

  Tools: Python, C++, PID Controller, NVIDIA Jetson, Computer Vision, ROS [[Link]]

  ◦ Developed an advanced drone system with robotic arms for automated bridge inspections

  ◦ Engineered a sophisticated PID controller to precisely manage the opening and closing mechanisms of robotic arms, ensuring optimal performance and safety during inspections

  ◦ Designed and implemented cutting-edge image processing algorithms for accurate girder detection, leveraging the computational power of NVIDIA Jetson platform

  ◦ Created a comprehensive demonstration showcasing autonomous flight, automatic clamping to bridge structures, and efficient traversal along inspection paths

- **Unmanned Aerial System of Visible Light, Infrared and Hyperspectral Cameras** *2020 - 2022*

  Tools: Python, Path Planning, Signal Processing, Data Analytics [[Link]]

  ◦ Developed a multi-modal UAV system with novel signal processing and data analytics capabilities

- **Robot-assisted Underwater Acoustic Imaging for Bridge Scour Evaluation** *2020 - 2021*

  Tools: Python, C++, ROS, Arduino, Embedded Linux, Computer Vision, PID Controller

  ◦ Developed robotic system for underwater acoustic imaging and bridge scour evaluation

- **Drone Visual Servoing Control System** *2015 - 2019*

  Tools: Python, Embedded Linux, Raspberry Pi, Computer Vision, Fractional Order Controller

  ◦ Designed and implemented a drone visual servoing control system using fractional order control techniques

- **SmarCaveDrone: Sense-and-avoid and GPS-denied Navigation** *2015 - 2017*

  Tools: Python, Computer Vision, Navigation Systems

  ◦ Developed cave mapping UAV system with sense-and-avoid capabilities and GPS-denied navigation

PATENTS AND PUBLICATIONS

C=CONFERENCE, J=JOURNAL, P=PATENT, S=IN SUBMISSION, T=THESIS

[C.1] Bo Shang, Yiqiao Li, Arian Golrokh Amin, Camille Kamga and Jie Wei. **Sensing Perspectives on Vulnerable Road User Monitoring for Traffic Safety: A Survey**. The 22nd International Conference on Mobile Systems and Pervasive Computing (MobiSPC), August 4-6, 2025 (accepted).

[C.2] Bo Shang, Yiqiao Li, Jie Wei and Camille Kamga. **How Many Beams of LiDAR is Enough for Detecting Vulnerable Road Users?** The 22nd International Conference on Mobile Systems and Pervasive Computing (MobiSPC), August 4-6, 2025 (accepted).

[J.1] Jinglun Feng, Bo Shang, Ejup Hoxha, César Hernández, Yang He, Weihan Wang, Jizhong Xiao. **Robotic Inspection and Data Analytics to Localize and Visualize the Structural Defects of Concrete Infrastructure**. IEEE Transactions on Automation Science and Engineering, 2025 (Presented at IROS 2025).

[J.2] Ejup Hoxha, Jinglun Feng, Agnimitra Sengupta, David Kirakosian, Yang He, Bo Shang, Ardian Gjinofci, and Jizhong Xiao. **Contrastive Learning for Robust Defect Mapping in Concrete Slabs using Impact Echo**. Construction and Building Materials (IF 7.4, cite score 13.8), 2024.

[J.3] Zhang, Haibin, Zhenhua Shi, Liujun Li, Pu Jiao, Bo Shang, and Genda Chen. **Code-specified early delamination detection and quantification in a RC bridge deck: passive vs. active infrared thermography**. Journal of Civil Structural Health Monitoring, 2024: 1-18.

[C.3] L. Li, B. Shang, I. Jayawardana and G. Chen, **Hardware-in-the-loop and Digital Twin Enabled Autonomous Robotics-assisted Environment Inspection**, 2023 6th International Symposium on Autonomous Systems (ISAS), Nanjing, China, 2023, pp. 1-5, doi: 10.1109/ISAS59543.2023.10164352.

[J.4] Genda Chen*, Liujun Li, Haibin Zhang, Zhenhua Shi, Bo Shang, Derek Edwards, Daniel McDonald, Rueil Manzambi, and Joseph Ressel. **Robot-assisted, Remote Nondestructive Testing and Evaluation (rNDT&E)**. Material Design, 2023.

[C.4] Haibin Zhang, Pu Jiao, Liujun Li, Zhenhua Shi, Bo Shang, Genda Chen, **Delamination detection of concrete bridge slab through UAV-based thermal scanning**, 8th World Conference on Structural Control and Monitoring (8WCSCM), 2022.

[C.5] Zhenhua Shi, Bo Shang, Haibin Zhang, Liujun Li, Genda Chen. **Evaluation of User-friendliness of Several UASs in Bridge Inspection**. 8th World Conference on Structural Control and Monitoring (8WCSCM), 2022.

[C.6] Liujun Li, Genda Chen, Bo Shang. **Mixed Reality Enabled Digital Twin for Robot-assisted Bridge element Inspection and maintenance**. 8th World Conference on Structural Control and Monitoring (8WCSCM), 2022.

[C.7] Jiao, P., Shang, B, Li, L., and Chen, G. **The ceiling effect and flight insight of unmanned aerial vehicles during proximity inspection of bridges via computational fluid dynamics modeling and simulations**, Proceedings of the 13th International Workshop on Structural Health Monitoring, August 31 – September 2, 2021, Stanford, CA, 2021. (online on Aug 1, 2022)

[C.8] Bo Shang, Liujun Li, Pu Jiao, Rafael Cardona Huerta, Joseph Ressel, Andrew Rawlings, Buddy Scharfenberg, and Genda Chen. **Drone vision-based clamping strategy for bridge inspection [Poster]**. INSPIRE-UTC 2021 Annual Meeting, 2021.

[C.9] B Shang, A Reven, P Jiao, B Li, G Chen. **Vision-Based Non-GPS UAV Guidance for Bridge Inspection [Poster]**. INSPIRE-UTC 2020 Annual Meeting, 2020.

[C.10] A Reven, P Jiao, B Shang, G Chen. **Clamping Design for Bridge Inspection Robot Deployment Systems (BIRDS) Prototype II [Poster]**. INSPIRE-UTC 2020 Annual Meeting, 2020.

[C.11] A Reven, P Jiao, B Shang, G Chen. **Bridge Inspection Robot Deployment Systems (BIRDS) Prototype II [Slides]**. INSPIRE-UTC 2020 Annual Meeting, 2020.

[J.5] Bo Shang, Jianxin Liu, Yunzhou Zhang, Chengdong Wu, YangQuan Chen. **Fractional Order Flight Control of Quadrotor UAS on Vision-based Precision Hovering with Larger Sampling Period**. Nonlinear Dynamics, 2019.

[C.12] Bo Shang, Chengdong Wu, YangQuan Chen. **Neighborhood optimization method for shaping Bode plot with larger phase margin**. Proceedings of the ASME 2019 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE), 2019.

[C.13] Bo Shang, Yunzhou Zhang, Chengdong Wu, YangQuan Chen. **Fractional Order Flight Control of Quadrotor UAS: an OS4 Benchmark Environment and a Case Study**. International Conference on Control, Automation, Robotics and Vision (ICARCV), 2018.

[C.14] Bo Shang, Chengdong Wu, Yunzhou Zhang, YangQuan Chen. **Fractional Order Flight Control of Quadrotor UAS: A Simscape Benchmark Environment and A Case Study**. 2018 IEEE Chinese Guidance, Navigation and Control Conference (CGNCC), Xiamen, 2018, pp. 1-6.

[C.15] Bo Shang, et al. **Analysis of Maximum Possible Sampling Period for a Real-Time Vision-Based Control System**. ASME 2017 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. American Society of Mechanical Engineers, 2017.

[C.16] Zhang, G., Shang, B., Chen, Y., & Moyes, H. **SmartCaveDrone: 3D cave mapping using UAVs as robotic co-archaeologists**. 2017 International Conference on Unmanned Aircraft Systems (ICUAS), 2017, pp. 1052-1057.

[C.17] B. Shang, J. Liu, T. Zhao and Y. Chen, **Fractional order robust visual servoing control of a quadrotor UAV with larger sampling period**, 2016 International Conference on Unmanned Aircraft Systems (ICUAS), Arlington, VA, 2016, pp. 1228-1234.

[J.6] Bo Shang, Chengdong Wu, Yuchao Hu, Jianyu Yang. **An Algorithm of Visual Reconnaissance Path Planning for UAVs in Complex Spaces**. Journal of Computational Information Systems, 10(19), 2014.

[C.18] Bo SHANG, Chengdong WU, Tingting MENG, Chengxi GAO, Yunzhou ZHANG. **A Data/Image Transmission Device Based on TCP/IP Protocol**. WiCOM2012 (International Conference on Wireless Communications, Networking and Mobile Computing), 2012.

[C.19] Tingting Meng, Chengdong Wu, Bo Shang, Chengxi Gao, Yunzhou Zhang. **Design of point to multi-point wireless communication system based on ZigBee**. WiCOM2011 (International Conference on Wireless Communications, Networking and Mobile Computing), 2011.

[J.7] GAO Chengxi, WU Chengdong, ZHANG Yunzhou, SHANG Bo, MENG Tingting. **Research on remote image/data transmission based on TCP/IP protocol**. Mechanical & Electrical Engineering Magazine, 2011.

[P.1] Chengdong Wu, Bo Shang, Yunzhou Zhang, Chengxi Gao, Tingting Meng. **Data/image transmission device based on TCP/IP (Transmission Control Protocol/Internet Protocol)** (CN 102427464 B).

[P.2] Yunzhou Zhang, Bo Shang, Chengdong Wu, Pengju Si, **Internet-based interactive digital media terminal device** (CN 102306237 A).

[P.3] G Chen, A Reven, B Shang, Z Shi, L Li, etc. **Unmanned vehicle having flight configuration and surface traverse configuration** (U.S. Patent No. 12,296,994. 13 May 2025).

Teaching Experience

- **ME 190: Mechatronics** *2016 - 2017*
  University of California, Merced
- **ME 143: Unmanned Aircraft Systems** *2016 - 2017*
  University of California, Merced
- **ME 021: Engineering Computing (Fortran and MATLAB)** *2016 - 2017*
  University of California, Merced
- **ENGR 204: Electric Circuits** *2023*
  CUNY City College
- **MCE 355: Robotics, Mechanics and Control** *2024*
  Vaughn College of Aeronautics and Technology
- **SBC 012: Principles of AI** *2024*
  Vaughn College of Aeronautics and Technology
- **SBC 014A: Principles of Research-AI** *2024*
  Vaughn College of Aeronautics and Technology

Honors and Awards

- **PhD Fellowship in Civil Engineering (Transportation)** *2025 - 2030*
  City College of New York (CCNY)
  ◦ Multi-year fellowship supporting doctoral studies in transportation engineering
- **Teaching Certificate** *2021*
  Association of College and University Educators (ACUE)
  ◦ Certification in effective teaching practices for higher education
- **Remote Pilot Certificate for Small Unmanned Aircraft Systems** *2016*
  Federal Aviation Administration (FAA)
  ◦ Licensed to operate small unmanned aircraft systems commercially
- **Financial Support for Exchange Program** *2015 - 2017*
  Chinese Scholarship Council (CSC)
  ◦ $38.4k financial support for two-year exchange program at University of California, Merced
- **Best System Control Award [Team Leader]** *2014*
  International Aerial Robotics Competition, AUVSI Foundation
  ◦ Recognized for outstanding system control implementation in international competition
- **Best Mission Planning Award [Team Leader]** *2014*
  International Aerial Robotics Competition, AUVSI Foundation
  ◦ Recognized for exceptional mission planning and execution

- **Meritorious Prize [Programmer]** *2010*
  International Mathematical Contest in Modeling, USA
  ◦ Awarded for outstanding performance in mathematical modeling competition
- **First Prize, Northeastern Region** *2010*
  National Smart Car Competition, Freescale, China
  ◦ Regional champion in smart car design and programming competition

Volunteer Experience

- **Coach** *2022*
  FIRST Robotics Competition (K-12 level)
  ◦ Mentored K-12 students in robotics design, programming, and competition strategy
- **Judge** *2024*
  VEX Robotics Competition (Middle, high school and college level)
  ◦ Evaluated robot performance and design in regional robotics competition
- **Tutor** *2023 - 2024*
  High School Research Assistant Program at CCNY
  ◦ Guided high school students in research methodology and scientific writing
- **Session Chair** *2016*
  International Conference on Unmanned Aircraft Systems (ICUAS) [[Link]]
  ◦ Organized and moderated conference sessions on unmanned aerial systems

Reviewer Contributions

Web of Science Profile
Nonlinear Dynamics http://www.springer.com/engineering/mechanics/journal/11071
International Conference on Unmanned Aircraft Systems http://www.uasconferences.com/
Journal of Intelligent & Robotic Systems http://www.editorialmanager.com/jint/default.aspx
ISA Transactions https://ees.elsevier.com/isatrans/mainpage.html
IEEE Transactions on Control Systems Technology http://www.ieeecss.org/publications/tcst
Intelligent Buildings International https://mc.manuscriptcentral.com/inbi
IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems
International Journal of Advanced Robotic Systems
https://us.sagepub.com/en-us/nam/international-journal-of-advanced-robotic-systems/journal202567
International Conference on Robotics and Automation
http://www.ieee-ras.org/conferences-workshops/fully-sponsored/icra
Control Engineering Practice https://www.journals.elsevier.com/control-engineering-practice
IET Control Theory and Applications http://digital-library.theiet.org/content/journals/iet-cta
Mechatronics https://www.journals.elsevier.com/mechatronics

Certifications

- **Remote Pilot Certificate for Small Unmanned Aircraft Systems**, Federal Aviation Administration (FAA) *2016*
- **Teaching Certificate**, Association of College and University Educators (ACUE) *2021*

Additional Information

Research Focus: AI-powered traffic monitoring, LiDAR-vision fusion for object detection, multimodal sensing and deep learning frameworks, autonomous robotic decision-making, drone-based infrastructure inspection, bridge condition assessment, vulnerable road user monitoring, data analytics for structural health monitoring

References

Available upon request.