Bo Shang

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Robotics Software Engineer | LiDAR + Camera Synchronization +1-929-520-0488
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Robotics software engineer with field-deployment experience in **multi-sensor pipelines, LiDAR + camera synchronization, and real-time perception**. Ships end-to-end systems from sensor capture and calibration through model training and edge inference. Granted US patent on autonomous robotic platform (US 12,296,994, 2025).

Experience

- **City University of New York — AI & Mobility Research Lab** New York, NY
  Postdoctoral Scholar *Jul 2025 – Present*
  - Designed and deployed end-to-end **fixed-LiDAR + camera pipeline** for highway traffic monitoring at NYC DOT sites; owned temporal synchronization, extrinsic calibration, and ingestion to training-ready datasets
  - Built **multi-frame point cloud reconstruction** that stitches successive LiDAR sweeps into per-vehicle models; tight LiDAR/camera time-sync as critical dependency
  - Implemented **configuration-portable** CNN training/inference loop: models trained on one site's sensor configuration redeployed to sites with different beam counts and mounting geometries
  - Co-authored two MobiSPC 2025 papers on VRU sensing and LiDAR beam-count requirements
- **City University of New York — Robotics Lab** New York, NY
  Postdoctoral Researcher *Dec 2022 – Dec 2024*
  - Led software stack for **Bridge Inspection Robot Deployment System (BIRDS)**: drone + robotic-arm clamping platform with multi-camera UAS payload (visible/IR/hyperspectral)
  - Engineered **vision-based girder detection** on NVIDIA Jetson; designed PID and fractional-order controllers for the clamping mechanism under wind and platform sway
  - Built iOS app for human-in-the-loop control; integrated ROS + Arduino + embedded Linux stack across air and underwater inspection robots
  - Equal-first-author IROS 2025 paper (IEEE T-ASE 2025) on robotic inspection and analytics for structural defects
- **Missouri University of Science and Technology** Rolla, MO
  Postdoctoral Fellow *Jan 2020 – Nov 2022*
  - Developed early BIRDS prototypes: PID communication protocol bridging flying and clamping subsystems on Raspberry Pi; **OpenCV + C++** girder detection
  - Built robot-assisted underwater acoustic imaging rig for bridge scour evaluation (ROS, Arduino, embedded Linux); led visual-odometry data-quality evaluation
- **University of California, Merced** Merced, CA
  Junior Specialist & Lecturer *Sep 2015 – Sep 2017*
  - Co-led **SmartCaveDrone** (ICUAS'17): SLAM platform for GPS-denied cave exploration with dense RGB-D reconstruction; fused IMU with KinectFusion-style dense visual SLAM
  - Drone visual servoing with fractional-order controllers on embedded Linux; lectured Mechatronics, Engineering Computing, and Unmanned Aerial Systems

Selected Projects

- **Highway LiDAR + Camera Synchronization Pipeline (2024–present)**: End-to-end multi-sensor capture with timestamp alignment, LiDAR/camera extrinsic calibration, background subtraction, CNN-based 3D detection of vehicles and vulnerable road users, and multi-frame vehicle reconstruction. Deployed at NYC highway sites.
- **BIRDS Bridge Inspection Robot Deployment System (2020–present)**: Autonomous drone + climbing-robot platform with multi-camera UAS payload, Jetson-based vision, PID/fractional-order clamping control, and iOS supervisor app. US Patent 12,296,994 granted May 2025.
- **Drone Visual Servoing with Fractional-Order Control (2015–2019)**: Closed-loop computer vision on Raspberry Pi enabling stable control under larger-than-typical sampling periods; foundation for ICUAS and IEEE conference papers.

Programming & Tools

- **Languages**: Python (primary), C++, MATLAB, Fortran, Swift
- **Robotics**: ROS / ROS 2, MCAP, Protobuf, NVIDIA Jetson (Nano/TX2/Xavier), DepthAI / OAK, Raspberry Pi, Arduino, embedded Linux
- **Sensors & Calibration**: LiDAR (multi-beam, solid-state), multi-camera rigs, IMU, depth/RGB-D, infrared, hyperspectral, underwater acoustic; intrinsic/extrinsic calibration, LiDAR–camera cross-calibration, temporal alignment (hardware triggers, PTP/NTP timestamp correction)
- **Perception & Control**: OpenCV, PyTorch, CUDA, CNN-based 3D/2D detection, sensor fusion, PID, fractional-order control, visual servoing
- **Infrastructure**: AWS (S3, EC2), Docker, Git/GitHub Actions, Linux/Ubuntu

Education

- **City College of New York (CUNY)** — New York, NY
  Ph.D. in Civil Engineering (Transportation) — Fellowship — *Aug 2025 – Present*
- **Northeastern University & University of California, Merced** — Shenyang, China / Merced, CA
  Ph.D. in Pattern Recognition & Intelligent Systems — *Aug 2013 – Dec 2020*
- **Northeastern University** — Shenyang, China
  M.Eng. in Pattern Recognition & Intelligent Systems; B.Eng. in Automation — *Aug 2007 – Dec 2013*

Patents & Awards

- **US 12,296,994** (granted May 2025) — Unmanned vehicle having flight configuration and surface traverse configuration
- **CN 102427464 B** — Data/image transmission device based on TCP/IP
- **FAA Part 107** Remote Pilot Certificate (Small Unmanned Aircraft Systems), 2016
- **Best System Control** & **Best Mission Planning** Awards — International Aerial Robotics Competition (AUVSI Foundation), 2014 *[team lead]*

Selected Publications

- **Bo Shang** et al. *Sensing Perspectives on Vulnerable Road User Monitoring for Traffic Safety: A Survey.* MobiSPC 2025.
- **Bo Shang** et al. *How Many Beams of LiDAR is Enough for Detecting Vulnerable Road Users?* MobiSPC 2025.
- J. Feng, **B. Shang**, et al. *Robotic Inspection and Data Analytics to Localize and Visualize the Structural Defects of Concrete Infrastructure.* IEEE T-ASE 2025. *[Selected for IROS 2025; equal first author]*