

Debao Huang

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Highlights: Self-implemented SfM Software (C++), FAA Remote Pilot

Interests: Photogrammetry, Computer Vision, Machine Learning, Deep Learning

Education

Ph.D. , Electrical and Computer Engineering, The Ohio State University, USA (Advisor: Rongjun Qin)	05/2026 (expected)
M.S. , Electrical and Computer Engineering, The Ohio State University, USA (Advisor: Rongjun Qin)	05/2023
B.S. , Telecommunication Engineering, Sun Yat-sen University, China	06/2019

Technical Skills

Programming Languages: C++, Python, MATLAB

Skills: 3D Reconstruction (SfM, NeRF, 3DGS, 4DGS), Bundle Adjustment, Uncertainty Quantification, Vision Foundation Models

Frameworks and Libraries: OpenCV, Ceres, Eigen, LASlib, Rasterio, PyTorch, Diffusers, COLMAP, OpenDroneMap, Metashape

Research Projects

Live 3D Gaussian Splatting for Intelligence, Surveillance, and Reconnaissance – AFRL	10/2024–Present
<ul style="list-style-type: none">Developed the first 4DGS pipeline to reconstruct dynamic urban scenes from monocular UAV video, achieving an improvement of 4 dB in PSNR for rendering moving objects.Integrated 4DGS with photogrammetry, video segmentation and tracking, monocular depth estimation, and physics-guided trajectory optimization into a unified reconstruction framework. (outcomes: P1).	
Uncertainty-Aware 3D Photogrammetric Reconstruction for Synthetic Environment – ONR	10/2022–Present
<ul style="list-style-type: none">Proposed a novel self-supervised uncertainty estimation method for MVS, enhancing accuracy by up to 54%, achieving SOTA performance on public aerial benchmarks.Implemented an uncertainty quantification framework for aerial and UAV photogrammetry. (outcomes: S2, P6).	
Walk-through Rendering from Images of Varying Altitude – IARPA	08/2023–08/2025
<ul style="list-style-type: none">Secured the leading position among 6 teams from over 20 universities and companies.Overcame the challenge of 3D reconstruction from heterogeneous data by integrating conventional SfM and deep learning-based feature matching methods. (outcomes: P2).	
Enabling Seamless 3D Semantic Reconstruction from Heterogeneous Data at Scale – ONR	01/2021–02/2025
<ul style="list-style-type: none">Developed SfM algorithms and introduced novel geometric constraints in bundle adjustment for multi-camera systems, enhancing accuracy by up to 86%. (outcomes: S1, H2, P3).Conducted the first study in the literature to assess PlanetScope satellite imagery for 3D reconstruction and change detection. (outcomes: P5).	

Software and System Development

[H1] Hardware: Waterproof Stereo Camera System with Synchronized Shutter	2025
<ul style="list-style-type: none">Developed the first fully synchronized stereo camera system for underwater coral reef imaging.Captured stereo image pairs to enable precise 3D reconstruction and measurement of coral morphologies, supporting creation of underwater 3D assets and benchmarks.	
[S1] Software: MetricSfM C++, OpenMP, CUDA, Ceres, Eigen	2024
<ul style="list-style-type: none">Developed an end-to-end Structure-from-Motion pipeline supporting heterogeneous data sources (aerial, UAV, GoPro, mobile, and underwater cameras) with both GUI and CLI interfaces.Integrated multiple pose solvers (P2), geometric constraints (P3), and robust georeferencing.	
[S2] Software: Uncertainty Quantification Framework C++, Python, Eigen, LASlib	2024
<ul style="list-style-type: none">Implemented uncertainty estimation for multi-view stereo (P6).Enabled storage of point-cloud error covariance matrices compliant with the Generic Point-Cloud Model standard from the National Geospatial-Intelligence Agency.	
[H2] Hardware: Low-cost Multi-camera Mobile Mapping Systems	2022
<ul style="list-style-type: none">Developed a low-cost, multi-camera ground mapping system using arbitrarily positioned GoPro cameras.Incorporated geometric constraints (P3) for multi-camera self-calibration in MetricSfM (S1), achieving robust 3D reconstruction while reducing equipment costs, enabling accessible 3D data collection for non-experts.	

Selected Publications

- [P1] **Huang, D.**, Liu, H., Xu, N., & Qin, R. (2025). "[Dynamic Urban Scene Modeling with 3D Gaussian Splatting from UAV Full Motion Videos](#)". *ISPRS Geospatial Week*.
- [P2] **Huang, D.**, Qin, R. (2025). "[Revisiting Minimal Solver of Camera Triplets for Incremental Structure-from-Motion](#)". *WACV Workshop*.
- [P3] **Huang, D.**, Qin, R., & Elhashash, M. (2024). "[Bundle Adjustment with Motion Constraints for Uncalibrated Multi-camera Systems at The Ground Level](#)". *ISPRS Journal of Photogrammetry and Remote Sensing*. **(IF:12.2)**.
- [P4] Xu, N., Qin, R., **Huang, D.**, & Remondino, F. (2024). "[Multi-tiling Neural Radiance Field \(NeRF\)—Geometric Assessment on Large-scale Aerial Datasets](#)". *The Photogrammetric Record*. **(Cover article of 12/2024 issue)**.
- [P5] **Huang, D.**, Tang, Y., & Qin, R. (2022). "[An Evaluation of PlanetScope Images for 3D Reconstruction and Change Detection—Experimental Validations with Case Studies](#)". *GIScience & Remote Sensing*.
- [P6] **Huang, D.**, Qin, R. (under review). "[Uncertainty Quantification Framework for Aerial and UAV Photogrammetry through Error Propagation](#)". *ISPRS Journal of Photogrammetry and Remote Sensing*. **(IF:12.2)**.

Certifications, Awards, and Media Coverage

- FAA-certified Remote Pilot; survey missions totaling 73.4 hectares and 47.8 km of flight path since 2021.
- [Outstanding Reviewer](#), *British Machine Vision Conference (BMVC)*, 2024.
- Research (P5) featured in Ohio State News: "[Using satellite data to help direct response to natural disasters](#)".