Debao Huang

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Profile: Ph.D. candidate specializing in large-scale 3D reconstruction, with experience in real-world deployments
Research Interests: 3D Computer Vision, Photogrammetry, Machine Learning, Deep Learning

Education

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

Technical Skills

Programming Languages: C++, Python, MATLAB
Skills: Large-scale 3D Reconstruction (SfM, NeRF, 3DGS, 4DGS), Vision Foundation Models, Generative AI, Multimodal Learning
Frameworks and Libraries: PyTorch, Diffusers, Nerfstudio, PEFT, Docker, OpenCV, Ceres, COLMAP
Certifications: FAA Remote Pilot. Executed survey missions totaling 73.4 hectares and 47.8 km of flight path.

Research Experience

Intrinsic Image Decomposition for Realism Enhancement of Digital Twins and 3D Assets – ONR 01/2025–Present
- Constructed a 33K+ image real-world dataset with pixel-aligned albedo, shading, normal, and metric depth using a physics-based inverse-rendering pipeline, enabling supervised intrinsic image decomposition.
- Fine-tuned Stable Diffusion models using LoRA to close sim-to-real gap, improving PSNR by 7 dB over SOTA and enabling downstream applications such as relighting and material editing. (Manuscript under review at **CVPR 2026**).

Live 3D Gaussian Splatting for Intelligence, Surveillance, and Reconnaissance – AFRL 10/2024–Present
- Developed a novel 4DGS pipeline to reconstruct dynamic urban scenes from monocular UAV video, achieving an improvement of 4 dB in PSNR over SOTA 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**).

Enabling Seamless 3D Semantic Reconstruction from Heterogeneous Data at Scale – ONR 01/2021–02/2025
- Developed SfM algorithms and introduced novel geometric constraints in bundle adjustment for multi-camera systems, enhancing the accuracy of camera pose estimation by up to 86%. (outcomes: **S1**, **H1**, **P2**).
- Developed a scalable Multi-Camera Tiling (MCT) NeRF framework for large-scale aerial datasets, reducing VRAM usage by 15.2% and significantly improving geometric completeness for fine structures. (outcomes: **P3**).

Software & System Development

[**S1**] **Software: MetricSfM** (Lead Developer) | C++, OpenMP, CUDA, Ceres, Eigen 2024
- Engineered 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. **Deployed to the Office of Naval Research**.

[**H1**] **Hardware: Multi-camera Mobile Mapping Systems** 2022
- Developed a low-cost ground-mapping system using arbitrarily positioned GoPro cameras, incorporating geometric constraints for multi-camera self-calibration in MetricSfM to achieve robust 3D reconstruction.

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., & Elhashash, M. (2024). "Bundle Adjustment with Motion Constraints for Uncalibrated Multi-camera Systems at The Ground Level". *ISPRS Journal of Photogrammetry and Remote Sensing*. (**Top-tier journal, IF:12.2**).

[**P3**] 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**).

[**P4**] **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*.

[**P5**] **Huang, D.**, Qin, R. (under review). "Uncertainty Quantification Framework for Aerial and UAV Photogrammetry through Error Propagation". *ISPRS Journal of Photogrammetry and Remote Sensing*. (**Top-tier journal, IF:12.2**).

Honors & Media Coverage

- Recipient of **Lyman J. Ladner Memorial Scholarship**, American Society for Photogrammetry and Remote Sensing, 2026. Awarded to outstanding students (**Top 1%**) pursuing research and careers in photogrammetry.
- Research on 3D reconstruction using satellite data for disaster response (**P4**), featured in **Ohio State News** [Link].