Xiangyu(Shawn) Xu, Ph.D.

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Expertise

3D Computer Vision: 3D/4D Reconstruction, NeRF, Gaussian Splatting, Visual Localization
2D Computer Vision: Super-Resolution, Feature extraction and matching
Robotics: 3D Scene Graph, Active Reconstruction, SLAM
Artificial Intelligence: Stable Diffusion, VLM

Technical Skills

Programming Languages: Python, MATLAB, C++, LaTeX
Python/Machine Learning : PyTorch, TensorFlow, OpenCV, Eigen, Scikit-learn, Numpy, Panda, Matplotlib
Developer Tools: Linux(Ubuntu), Windows, ROS, Git, Docker, Conda

Education

Stevens Institute of Technology **Aug 2017 – Aug 2022**
PhD, Computer Science, Advisor: Enrique Dunn *Hoboken, NJ*

Stevens Institute of Technology **Aug 2015 – June 2017**
MS, Mechanical Engineer, Advisor: Brendan Englot *Hoboken, NJ*

Hunan University **July 2010 – June 2014**
BS, Mechanical Engineering, Advisor: Xiang Zhong *Hunan, China*

Experience

Innopeak Technology, Inc.(OPPO US Research Center) **Aug 2022 – Present**
Senior Research Engineer, Manager: Yi Xu *Palo Alto, CA*

- Developed advanced algorithms and systems for **AI wearable device (glasses)** applications:
  - Diffusion-based image super-resolution and deblurring for enhanced visual quality.
  - Open-vocabulary 3D scene graph reconstruction to support localization and navigation.
- Developed advanced algorithms and systems for **XR (AR/VR/MR)** applications:
  - 3D/4D photography/videography for immersive content creation.
  - 3D Reconstruction and Scene Understanding.

Wormpex AI Research LLC. **May 2021 – Aug 2021**
3D Computer Vision Research Intern, Manager: Gang Hua *Bellevue, WA*

- Conducted cutting-edge research in learning-based feature matching and camera poses estimation problems.
- Coded the algorithm using the deep learning framework PyTorch and compared it with the state-of-the-art methods.

Amazon Lab126 **May 2019 – Aug 2019, May 2020 – Aug 2020**
Applied Scientist Intern (Astro home robot), Manager: Arnie Sen *Sunnyvale, CA*

- Worked on the problem of 3D map alignment under strict conditions such as noise, outliers, and large non-overlapping areas and tested the algorithms on the home robot Astro.
- Solved the feature correspondence selection problem under strict conditions such as texture-less feature, low light, and day-night difference and evaluated the algorithms on Amazon Web Service.

The Robust Field Autonomy Lab **May 2016 – May 2017**
Research Assistant, Advisor: Brendan Englot *Hoboken, NJ*

- Designed algorithms, optimization methods, and control systems for robust and autonomous mobile robotics.
- Considered applications such as underwater surveillance, inspection, autonomous exploration, and path planning.

Projects

Diffusion-based Real-World Image Super-Resolution (Real-ISR) **2024 – 2025**

- Designed and implemented a one-step diffusion-based approach specifically optimized for the Real-World Image Super-Resolution (Real-ISR) task, delivering enhanced image quality and detail reconstruction.
- Streamlined the pipeline to improve efficiency and reduce resource consumption, ensuring a more practical and scalable solution for Real-ISR applications.

LLM-Based Open-Vocabulary 3D Scene Graph Construction. **2023 – 2024**

- Developed a robust framework for constructing 3D scene graphs by integrating object captions and relational insights generated by a large language model (LLM).
- Made significant progress toward the development of LLM-based navigation instructions based on 3D scene graphs.
- Enhanced 3D scene reconstruction and monocular camera registration techniques to handle noisy capture data, enabling the creation of accurate and contextually rich scene graphs from uncalibrated RGB data.

3D/4D Photography/Videography **2022 – 2024**

- Develop transformative technologies to convert stereoscopic and monocular media (photos/videos) into immersive 6DoF experiences for MR devices, optimizing streaming and on-device viewing.
- Build frameworks and collaborate with cross-functional teams, contributing across all stages, including data collection, algorithm development, deployment, and testing.
- Utilize advanced techniques such as:
  - **Data Simulation**: Generate dynamic video scenes using Habitat-Simulator.
  - **Scene Understanding**: Implement semantic segmentation, image matting, and depth estimation.
  - **AIGC**: Apply Stable Diffusion-based inpainting for content generation.
  - **Efficient Rendering**: Leverage layered representations, NeRF, and Gaussian Splatting.

Neural Active Reconstruction from Uncertain Target Observations **2023 – 2024**

- Designed a neural active reconstruction system that combines a hybrid neural representation with uncertainty learning, enabling high-fidelity surface reconstruction.
- Achieved exceptional active reconstruction performance, advancing state-of-the-art in reconstruction completeness from 73% to 90%.
- Published an open-source package: NARUTO.

High-Fidelity RGB-D Reconstruction via dynamic voxel grid optimization **2022 – 2023**

- Developed a novel 3D surface reconstruction method that directly regresses SDF from calibrated color and depth images without leveraging any MLP component.
- Designed a hierarchical structure which enables highly efficient scene representation and detailed geometry recovery and a partitioning strategy for adaptive voxel subdivision during optimization.

Learning feature correspondence for Visual Localization **2021 – 2022**

- Developed a learning-based camera pose estimation method that end-to-end solves key points detecting, feature matching, and pose estimation problems under only the weak supervision of the ground truth camera position.
- Compared with the state-of-the-art methods and submitted to the top-tier computer vision conferences.

Deep learning-based multi-view Dynamic 3D Reconstruction **2019 – 2020**

- Built a self-supervised learning framework for the reconstruction of sparse dynamic 3D geometry and the recovery of spatio-temporal relationships among our input 2D observations.
- Proposed a cascaded training framework for efficient training of a general network architecture.
- Published an open-source package: GTT-Net.

Video-based Dynamic 3D Reconstruction **2018 – 2019**

- Developed a general paradigm for sparse dynamic 3D points reconstruction and image sequence recovery from multiple independent and uncontrolled image streams having arbitrary temporal sampling density and distribution.
- Performed experiments on both synthetic and real imagery with reconstructability numerical analysis.
- Published an open-source package: DLOE_dynamic_3D_reconstruction.

Autonomous Exploration and mapping of Complex 3D Environment **2016 – 2017**

- Designed a robust algorithm for exploring complex three-dimensional environments and simulate it in MATLAB.
- Tested the algorithm in a ground robot equipped with ranging sensor in a complex environment.
- Published an open-source package in ROS Wiki: turtlebot_exploration_3d .

Publications and Patents

- L. Chen, H. Zhan, K. Chen, **Xu, Xiangyu**, Q. Yan, C. Cai, and Y. Xu, "Activegamer: Active gaussian mapping through efficient rendering," *arXiv preprint arXiv:2501.06897*, 2025.
- Z. Zhang, P. Ji, N. Bansal, C. Cai, Q. Yan, **Xiangyu Xu**, H. Zhan, and Y. Xu, *Methods and apparatus for optical flow estimation with contrastive learning*, WO2024081455A1, Filed June 2023, issued April 2024, 2024.
- Z. Feng, H. Zhan, Z. Chen, Q. Yan, **Xu, Xiangyu**, C. Cai, B. Li, Q. Zhu, and Y. Xu, "Naruto: Neural active reconstruction from uncertain target observations," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, 2024, pp. 21 572–21 583.
- Z. Chen, Q. Yan, H. Zhan, C. Cai, **Xu, Xiangyu**, Y. Huang, W. Wang, Z. Feng, L. Liu, and Y. Xu, "Planarnerf: Online learning of planar primitives with neural radiance fields," *arXiv preprint arXiv:2401.00871*, 2023.
- **Xu, Xiangyu**, L. Chen, C. Cai, H. Zhan, Q. Yan, P. Ji, J. Yuan, H. Huang, and Y. Xu, "Dynamic voxel grid optimization for high-fidelity rgb-d supervised surface reconstruction," *arXiv preprint arXiv:2304.06178*, 2023.
- **Xu, Xiangyu**, L. Guan, E. Dunn, H. Li, and G. Hua, "Ddm-net: End-to-end learning of keypoint feature detection, description and matching for 3d localization," *arXiv preprint arXiv:2212.04575*, 2022.
- Z. Zhang, N. Bansal, C. Cai, P. Ji, Q. Yan, **Xu, Xiangyu**, and Y. Xu, "Clip-flow: Contrastive learning by semi-supervised iterative pseudo labeling for optical flow estimation," *arXiv preprint arXiv:2210.14383*, 2022.
- **Xu, Xiangyu**, "Generalized dynamic 3d reconstruction," Ph.D. dissertation, Stevens Institute of Technology, 2022.
- **Xu, Xiangyu** and E. Dunn, "Gtt-net: Learned generalized trajectory triangulation," in *Proceedings of the IEEE/CVF International Conference on Computer Vision*, 2021, pp. 5795–5804.
- **Xu, Xiangyu** and E. Dunn, "Discrete laplace operator estimation for dynamic 3d reconstruction," in *Proceedings of the IEEE/CVF International Conference on Computer Vision*, 2019, pp. 1548–1557.

Academic services

Conference/Journal Reviewer

Computer Vision: CVPR; ICCV; ECCV; ACCV; ICPR
Robotics: RA-L
Artificial Intelligence: IJCAI; IJCNN

Honors and Awards

Excellence in Graduate Research Award **May 2023**
Stevens Institute of Technology *Hoboken, NJ*