

Christo Aluckal

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Buffalo, New York - 14208, United States

ABOUT ME

I focus on creating adaptive and practical tools that make robotic autonomy more robust, deployable, and impactful across real-world applications.



EXPERIENCE

- **DRONESLab** Oct 2022- Present
Graduate Research Assistant / PhD Candidate Buffalo, United States
 - Developed TERA, a ROS based simulation framework in Unity3D for autonomous excavators allowing user customization of hardware parameters and sensor specifications
 - Created a ROS wrapper for low-level excavator control allowing autonomous control
 - Developed an incremental training strategy for 3D Gaussian Splatting (3DGS) that enables real-time, memory-efficient scene reconstruction on edge and low-power devices allowing for a 33% reduction in training time
 - Assisted in developing software to allow autonomous inspection in low-light environments such as culverts
- **InfiCorridor Solutions Pvt. Ltd.** May 2020 — Jul 2022
Intern / Part-Time Mumbai, India
 - Developed PixTrigger, an open source framework for capturing and geotagging images interfaceable with more than 100 cameras in Python and C/C++
 - Developed the No Permission No Take-off system in C/C++ which verifies digital signatures in compliance with the Directorate General of Civil Aviation standards allowing only authorized UAV missions to take place
 - Experienced in auditing data, developing data, performing data validation, data verification and improve the efficiency for GIS applications
 - Planned and executed multiple autonomous UAV missions to generate images and maps for Digital Elevation/Terrain Models

EDUCATION

- **University at Buffalo** Jan 2025 - Present
Doctor of Philosophy, Computer and Information Science Buffalo, United States
- **University at Buffalo** Aug 2022 - Jan 2025
Master of Science, Computer and Information Science Buffalo, United States
 - GPA: 3.53/4.00
 - Relevant Courses: Machine Learning, Reinforcement Learning, Robotics Algorithms, Computer Vision & Image Processing, Learning for Autonomous Systems
- **Mumbai University** Aug 2016 - Oct 2021
Bachelor of Engineering, Computer Engineering Mumbai, India
 - Grade: 8.44/10.00
 - Relevant Courses: Machine Learning, Digital Signal & Image Processing

PROJECTS

- **Master's Thesis: TERA: Simulation Environment for Terrain Excavation Robot Autonomy** 
Tools: [Unity, C#, ROS]
 - Designed TERA (Terrain Excavation Robot Autonomy), a simulator supporting real-time operation and high-fidelity modeling of autonomous excavators and its terrain interactions
 - Incorporated time-varying dynamics to study the challenges of full excavation autonomy
 - Allows users to spawn multiple sensors (Cameras, IMUs, LiDARs) and specify their characteristics
 - Validated the simulator with scenarios including track deformation, velocity profiles, and real-to-sim similarity, enabling systematic evaluation of excavation autonomy algorithms
- **Splat-by-Splat: Progressive Gaussian Splatting for Efficient Scene Reconstruction** 
Tools: [Python, Pytorch, CUDA, Colmap]
 - Proposed an incremental training strategy for 3D Gaussian Splatting (3DGS) to overcome memory and compute limitations of conventional full-dataset training
 - Developed a partitioning algorithm that takes a COLMAP scene and splits it into user defined chunks sequentially or based on geometric constraints

- Developed a sequential dataset integration approach enabling real-time scene reconstruction on edge and low-power devices
- Extended the original 3DGS implementation to include incremental updates to training dataset

• Learning Visual Information Utility with PIXER

Tools: [Python, BNNs, PySLAM, Optuna]



- Conducted experimental evaluation of PIXER, a probabilistic feature-selection method for visual odometry
- Collected and curated the custom Davis dataset using a ZED 2i camera and Mosaic X5 GNSS mounted on a Boston Dynamics Spot
- Integrated PIXER outputs into the VO pipeline PySLAM and implemented Optuna-driven, parallel hyperparameter optimization (6 concurrent studies) to systematically benchmark accuracy, runtime, and keypoint efficiency and persist reproducible optimal configurations.
- Demonstrated 34% mean RMSE reduction and 41–49% keypoint reduction, enabling faster VO using lightweight detectors (e.g., Shi-Tomasi) while maintaining or improving accuracy

PUBLICATIONS

C=CONFERENCE, J=JOURNAL, P=PATENT, S=IN SUBMISSION, T=THESIS, W=WORKSHOP, PO=POSTER

- [C.1] C. Aluckal et al (2025). "**TERA: A Simulation Environment for Terrain Excavation Robot Autonomy**". In *2025 IEEE International Conference on Simulation, Modeling, and Programming for Autonomous Robots (SIMPAN)*, Palermo, Italy, 2025, pp. 1-6, doi: 10.1109/SIMPAN62925.2025.10979147
- [Po.1] C. Aluckal, C. Adhivarahan, K. Dantu. **Splat-by-Splat: Progressive Gaussian Splatting for Efficient Scene Reconstruction**. In *NERC 2025, Cornell, Ithaca*
- [C.2] Yash Turkar; **Christo Aluckal**; Shaunak De; Varsha Turkar; Yogesh Agarwadkar (2022). **Generative-Network Based Multimedia Super-Resolution for Uav Remote Sensing**. In *IGARSS 2022 - 2022 IEEE International Geoscience and Remote Sensing Symposium, Kuala Lumpur, Malaysia, 2022*, pp. 527-530, doi: 10.1109/IGARSS46834.2022.9884486.
- [C.3] Y. Turkar, **C. Aluckal**, C. Adhivarahan, A. Sebastiani, and K. Dantu, **A view-planning approach to 3d reconstruction**. In *International Conference on Extended Reality, Springer, 2024*, pp. 340–350
- [W.1] Y. Turkar, **C. Aluckal**, S. Sreedharan, Y. Dighe, Y. Kim, J. Gemerek, and K. Dantu (2025) **Excavation autonomy with resilient traversability and handling**. In *Workshop on Field Robotics (WFR), International Conference on Robotics and Automation (ICRA) 2025*
- [S.1] Y. Turkar, T. Chase Jr, **C. Aluckal**, and K. Dantu, **Learning Visual Information Utility with PIXER**. In *arXiv preprint arXiv:2409.13151 (2024)*

SKILLS

- **Programming Languages:** Python, C, C++, C#, OCaml
- **Web Technologies:** HTML, CSS, Javascript, Bootstrap, Flask, Django
- **Data Science & Machine Learning:** Numpy, Pandas, Matplotlib, OpenCV, PyTorch, Keras, Tensorflow, Optuna, WandB
- **Version Control:** Git
- **Specialized Area:** ROS 1/2, Robotics, Unity, MATLAB, CAD, \LaTeX , Metashape
- **Research Skills:** Data Collection & Analysis, Literature Review, Academic Writing
- **Other Tools & Technologies:** Adobe Photoshop, GIMP, Adobe Premier, KDENLive, Blender

AWARDS

- **Just Joe Sportsmanship Award** June 2019
Student Unmanned Aerial Systems Competition [Page 20
- **CSE Faculty Choice Award** May 2025
University at Buffalo

REFERENCES

1. **Dr. Karthik Dantu**
Associate Professor, Department of Computer Science and Engineering
School of Engineering and Applied Sciences, University at Buffalo
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Relationship: Thesis Advisor, Research Advisor