Alex Zihao Zhu

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RESEARCH INTERESTS

Computer vision and robotics, with special interests in 3D perception, segmentation, autonomous driving, event-based cameras and foundation models.

EXPERIENCE

Waymo LLC.   Mountain View, California
Senior Research Scientist   June 2022-Current
Research Scientist   January 2020-June 2022
- Responsible for upgrading and maintaining Waymo's onboard segmentation stack.

- Developing new machine learning models to improve the overall system and address challenging edge cases, incorporating them into large multi-task models and ultimately deploying them onboard with an eye on latency and overall system performance.

- Led the deployment of features which are now the primary segmentation pipeline for all of Waymo's vehicles, improving previous segmentation performance by ¿ 20%.

- Published numerous papers at top conferences, and led the developing and hosting of the Waymo Open Dataset: 2D Video Panoptic Segmentation challenge.

- Now researching more broadly foundation models for autonomous vehicle perception.

Zoox Inc.   Menlo Park, California
3D Perception Intern   May 2017-August 2017
- Developed a nonlinear optimization algorithm for 3D tracking of objects from multiple sensing modalities such as cameras, lidar and radar for autonomous vehicles.

GRASP Lab   Philadelphia, Pennsylvania
Doctoral Student   August 2014-December 2019
Research
- Developed novel algorithms for event-based cameras to solve motion estimation tasks in difficult scenes such as high speed motions and challenging lighting.

DARPA Fast Lightweight Autonomy Program
- Developed algorithms for high speed flight using event based cameras, with an end goal of flying a quadrotor at up to 20m/s through cluttered environments.

Glaxo Smith Kline Lab Automation
- Developed a full pipeline for transparent object detection and visual servoing based grasping and manipulation using the Baxter robot in a long term project to automate chemical laboratories.

DARPA Robotics Challenge
- Developed a stereo vision based obstacle map generator for a teleoperated driving task for Team Trooper (in conjunction with Lockheed Martin). Driving task was successfully completed on both days.

Duke Robotics and Manufacturing Automation Laboratory   Durham, North Carolina
Pratt Engineering Undergraduate Research Fellow   January 2013 - May 2014

EDUCATION

University of Pennsylvania
PhD, Computer and Information Science   August 2014-December 2019
Master of Science in Engineering in Robotics   August 2014-May 2016
Advisor: Dr. Kostas Daniilidis

Duke University   August 2010-May 2014
Bachelor of Science in Engineering, magna cum laude
Majors: Electrical and Computer Engineering and Computer Science
Advisor: Dr. Michael Zavlanos
Robertson Scholar, Class of 2014

PUBLICATIONS

For the most up to date list of publications, please check Google Scholar.

[20] Z. Xiao, L. Jing, S. Wu, **A.Z. Zhu**, J. Ji, C.M. Jiang, W.C. Hung, T. Funkhouser, W. Kuo, A. Angelova, Y. Zhou, S. Sheng, **3D Open-Vocabulary Panoptic Segmentation with 2D-3D Vision-Language Distillation**, *Submitted to CVPR 2024*

[19] **A.Z. Zhu**, J. Mei, S. Qiao, H. Yan, Y. Zhu, L.C. Chen, H. Kretzschmar, **Superpixel Transformers for Efficient Semantic Segmentation**, *IROS 2023*

[18] J. Mei, **A.Z. Zhu**, X. Yan, H. Yan, S. Qiao, L.C. Chen, H. Kretzschmar, **Waymo Open Dataset: Panoramic Video Panoptic Segmentation**, *ECCV 2022*

[17] **A.Z. Zhu**, V. Casser, R. Mahjourian, H. Kretzschmar, S. Pirk, **Instance Segmentation with Cross-Modal Consistency**, *IROS 2022*

[16] **A.Z. Zhu**, Z. Wang, K. Khant, K. Daniilidis, **EventGAN: Leveraging large scale image datasets for event cameras**, *ICCP 2021*

[15] C. Lee, A.K. Kosta, **A.Z. Zhu**, K. Chaney, K. Daniilidis, K. Roy, **Spike-flownet: event-based optical flow estimation with energy-efficient hybrid neural networks**, *ECCV 2020*

[14] K. Chaney, **A.Z. Zhu**, K. Daniilidis, **Learning Event-based Height from Plane and Parallax**, *International Conference on Intelligent Robots and Systems (IROS) 2019.*

[13] **A.Z. Zhu**, L. Yuan, K. Chaney, K. Daniilidis, **Unsupervised Event-based Learning of Optical Flow, Depth, and Egomotion**, *Conference on Computer Vision and Pattern Recognition (CVPR) 2019.*

[12] **A.Z. Zhu***, W. Liu*, Z. Wang, K. Daniilidis, **Robustness Meets Deep Learning: An End-to-End Hybrid Pipeline for Unsupervised Learning of Egomotion**, *Conference on Computer Vision and Pattern Recognition (CVPR) 2019, Workshop on Deep Learning for Semantic Visual Navigation.*

[11] K. Chaney, **A.Z. Zhu**, K. Daniilidis, **Learning Event-based Height from Plane and Parallax**, *Conference on Computer Vision and Pattern Recognition (CVPR) 2019, Event-based Vision Workshop.*

[10] **A.Z. Zhu**, Y. Chen, K. Daniilidis, **Realtime Time Synchronized Event-based Stereo**, *European Conference on Computer Vision (ECCV) 2018.*

[9] **A.Z. Zhu**, L. Yuan, K. Chaney, K. Daniilidis, **Unsupervised Event-based Optical Flow using Motion Compensation**, *European Conference on Computer Vision (ECCV) 2018, What is Optical Flow For? Workshop. Also presented as a live demo session.*

[8] **A.Z. Zhu**, L. Yuan, K. Chaney, K. Daniilidis, **EV-FlowNet: Self-Supervised Optical Flow Estimation for Event-based Cameras**, *Robotics: Science and Systems (RSS) 2018.* **Best Student Paper Finalist, 1 of 3**.

[7] **A.Z. Zhu**, D. Thakur, T. Özaslan, B. Pfrommer, V. Kumar, K. Daniilidis, **The Multi-Vehicle Stereo Event Camera Dataset: An Event Camera Dataset for 3D Perception**, *IEEE Robotics and Automation Letters (RA-L) 2018*, presented at *IEEE International Conference on Robotics and Automation (ICRA) 2018.*

[6] K. Mohta, M. Watterson, ..., **A.Z. Zhu**, et al., **Fast, Autonomous Flight in GPS-Denied and Cluttered Environments**, *Journal of Field Robotics 15 Dec 2017.*

[5] **A.Z. Zhu**, N. Atanasov, K. Daniilidis, **Event-based Visual Inertial Odometry**, *Conference on Computer Vision and Pattern Recognition (CVPR) 2017.*

[4] C. Freundlich, Y. Zhang, **A.Z. Zhu**, P. Mordohai, M. Zavlanos, **Controlling a Robotic Stereo Camera Under Image Quantization Noise**, *The International Journal of Robotics Research 22 Oct 2017.*

[3] **A.Z. Zhu**, N. Atanasov, K. Daniilidis, **Event-based Feature Tracking with Probabilistic Data Association**, *IEEE International Conference on Robotics and Automation (ICRA) 2017.*

[2] S. Farhadi, R. P. Behringer, **A.Z. Zhu**, **Stress Relaxation for Granular Materials near Jamming Under Cyclic Compression**, *Physical Review Letters 29 Oct 2015.*

[1] S. Farhadi, R. P. Behringer, **A.Z. Zhu**, **Slow Dynamics for Elliptical Particles under Continuous Shear and Cyclic Compression**, *Powders and Grains 2013.*