Zachary W. Zhao

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SUMMARY

- Experienced Python developer with 5+ years in 2D/3D computer vision, interdisciplinary research, and collaborative projects. Skilled in defining evaluation metrics, building scalable systems, managing large datasets, cloud-based deep learning, and implementing DevOps/MLOps practices, CI/CD pipelines for efficient model development and deployment.
- **Certifications:** Machine Learning, Deep Learning Specialization, Self-Driving Cars Specialization, Reinforcement Learning Specialization, Data Structures & Algorithms

EDUCATION

Worcester Polytechnic Institute — **Worcester, MA**
Ph.D. in Robotics Engineering (GPA: 4.0) — *Dec 2024 – Present*
Research Domain: Multimodal perception, Embodied AI - VLA

University of Washington — **Seattle, WA**
M.S. in Electrical and Computer Engineering (GPA: 3.84) — *Sep 2022 – Aug 2024*
Research Domain: Computer Vision, Multimodal perception, Autonomous Driving

SKILLS

Python | C/C++ | Java | SQL | MATLAB | PyTorch | TensorFlow | Azure | CUDA | UE | CV | ML | DL | LabVIEW | Linux | ROS | Rviz | Keil | Catia | AutoCAD | Arduino | STM32 | RPi | Git | PCB | 3D Print | HTML5 | CSS | React | D3.js | Node.js

PUBLICATION & PATENTS

- Zhao, W., et al. Interval Short-Term Traffic Flow Prediction Method Based on CEEMDAN-SE Noise Reduction and LSTM Optimized by GWO. Wireless Communications and Mobile Computing, 2022.
- A method for fruit recognition based on deep learning neural network. (CN 114677672A, Jun 2022)
- A Self-adapting Wind-driven Generator (CN 212106125U, Dec 2020)
- Multi-Parameter Measuring Device for Solid-Liquid Two-Phase Flow (CN208818259U, May 2019)

WORK EXPERIENCE

UW RAIVN Lab — **Seattle, WA**
Robotics Research Assistant | *Multimodal perception for Embodied AI* — *Oct 2024 - Present*
- Developed and implemented SOTA perception strategies leveraging the Vision-Language-Action (VLA) framework to enable robots to efficiently perceive, reason, and act in real-world scenarios.

AUTEV — **Seattle, WA**
Lead Robotics & Computer Vision Engineer | *Autonomous robots for hassle-free EV charging* — *Jun 2024 - Present*
- Led the development of DL-based vision-guided pipeline (Intel RealSense & NVIDIA Jetson), enabling precise and autonomous connection of the robotic arm charging gun to the EV charging port.
- Led the design and deployment of full-stack app solutions (React & FastAPI) for user interaction with the robotic system.
- Directed the complete development of vehicle perception, localization, and navigation pipelines using NVIDIA Isaac Sim. Integrated sensor fusion techniques and SLAM algorithms to enhance navigation accuracy.

Visionify Inc. — **Seattle, WA**
Computer Vision Engineer | *Enhanced workplace safety through DL computer vision techs* — *Mar 2024 – Jun 2024*
- Analyzed 3,000+ workplace videos to identify and reduce false positives in PPE detection.
- Developed the PreValidator4PPE pipeline with YOLOv8-pose achieving 91.88% accuracy in human body part detection.
- Integrated the PreValidator4PPE into the company's detection workflow reducing FP by over 80% across 7 PPE criteria.

Information Processing Lab UW — **Seattle, WA**
ML Research Assistant | *Advance CV research in Autonomous Driving Domain* — *Jun 2023 – Mar 2024*
- Mitigated offset issues for provided datasets by designing and implementing advanced 3D constrained multi-core image algorithms, contributing to the improvement of driving datasets with a focus on detection accuracy in complex scenarios.
- Established a baseline for the CMKD method on a custom dataset using OpenPCDet framework, laying the foundation for further model improvements and application-specific tuning.

Autonomous Agents Research Group UOE — **Edinburgh, UK**
AD Research Assistant | *Motion planning and prediction systems for autonomous vehicles* — *Apr 2023 – Aug 2023*
- Enhanced prediction and motion planning systems for autonomous vehicles by incorporating seven scenarios with on-ramps and off-ramps using Python and the RoadRunner into IGP2 AD framework.
- Enhanced navigational capabilities in diverse driving environments by better simulating real-world traffic conditions.

RESEARCH EXPERIENCE

Machine Learning for Extreme Traverse Lunar Explorer — **NASA JPL & UW ENGINE Capstone**

Jan 2023 – June 2023

- Developed and applied 2D machine learning algorithms in Python and Linux to semantically segment real-world on-field datasets from JPL's EELS and IceNet, enabling hazard identification in harsh subterranean conditions on Earth and the Moon.
- Implemented non-supervised domain adaptation for robust semantic segmentation in unknown environments. Evaluated and compared unsupervised, semi-supervised, and non-deep learning methods to determine the most deployable approach for extraterrestrial missions.
- Pioneered a flexible zero-shot data generation pipeline, automating pixel-perfect semantic labeling without manual human annotations.

Machine Learning Cybersecurity, University of Washington *Apr. 2023 - June 2023*

- Utilized TensorFlow and Keras in python to adapt LeNet-5, VGG-16, and InceptionV1 (GoogLeNet) architectures for adversarial machine learning experiments.
- Implemented FGSM and DeepFool attacks on MNIST dataset, reducing test accuracy from 96.53% to 21.36%.
- Applied Distillation Defense and Randomized Smoothing techniques in python, achieving 98.69% accuracy under adversarial perturbations and identifying optimal sigma values for balancing robustness and performance.

Tuning-PlaySite, University of Washington *Apr. 2023 - June 2023*

- Developed and designed an interactive online tool for exploring and analyzing hyperparameter tuning in machine learning models, aiding users in selecting optimal settings for improved model performance.
- Created a user-friendly interface using Java and HTML5 that enables users to experiment with various hyperparameter configurations and visualize the results, facilitating informed decision-making in hyperparameter tuning for enhanced model accuracy.

TinyML-Weather-Wizard, University of Washington *Apr. 2023 - June 2023*

- Developed and optimized a sophisticated weather forecasting model using Python utilizing diverse datasets to accurately predict Seattle's weather conditions.
- Employed advanced model compression techniques and implemented periodic updates for efficient deployment on resource-constrained hardware in C++, specifically the Arduino Nano 33 device. This resulted in a compact and computationally efficient solution without compromising prediction accuracy.

Self-Driving Robot Path Planning project, University of Washington *Oct. 2022 - Dec. 2022*

- Led the development of an autonomous driving robot using Python in Linux system, leveraging the Robot Operating System (ROS) architecture in a dynamic open environment.
- Designed and implemented technologies for precise environmental mapping, adaptive path planning A*, real-time navigation, and intelligent decision-making, showcasing a grasp of mobility and automation concepts.

Vision Module Leader, China Agricultural Robot Competition *July 2021 - Oct. 2021*

- Implemented advanced 2D image processing techniques, including first and second-order derivative algorithms for image intensity analysis in LabVIEW, successfully isolating the maximal differential in image data. This approach effectively mitigated the effects of varying sunlight intensity and sampling frequency in open-space environments.
- Applied video image single frame sequential sequence extraction filter to suppress noise.
- Innovatively utilized continuous images to extract the target edge coordinates and averaged the gray values of several points in the maximum possible target neighborhood, made the accuracy of model recognition improved from 40% to 90%
- Won the **First Prize & Best Innovation Award**

Multi-Parameter Detection System for Acoustic Attenuation Data Inversion of Solid-Liquid Two-Phase Flow (National Entrepreneurship Training Project) *May 2020 - May 2021*

- Constructed inverse multi-parameter prediction models in Matlab by incorporating acoustic attenuation and acoustic propagation theories.
- Designed and created PCB circuit diagrams for the control system, and programmed electric control systems in C++.
- Developed a three-layer forward neural network based on the BP neural network for multiple return amplitudes and reflection coefficients to train samples with varying concentrations, resulting in an error deviation within 0.3%.
- Won the **Grand Prize (provincial)** and the **Third Prize (national)**

HONORS

- Provincial Outstanding Graduate (2021), Merit Student (2021), National Encouragement Scholarship (2020 & 2019), Postgraduate Academic Scholarship (2021), CUMCM Provincial First Prize (2019), Outstanding Class Leader (2019)