

ZHANKUN LUO

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EDUCATION

Purdue University West Lafayette

Ph.D. in Electrical and Computer Engineering GPA 3.95/4

West Lafayette, IN

Aug 2021 – Present

Purdue University Northwest

Master in Electrical and Computer Engineering GPA 3.96/4

Hammond, IN

Aug 2019 – May 2021

Beijing Institute of Technology

Bachelor in Telecommunication Engineering GPA 85/100

Beijing, China

Sept 2015 – Jun 2019

TECHNICAL SKILLS

Programming: Python, C/C++, Java, Bash, SQL, C#, MATLAB, Mathematica, \LaTeX

Frameworks: DL (PyTorch, TensorFlow), Data Processing (NumPy, Scipy, scikit-learn, pandas), Computer Vision (OpenCV, eigen3, Sophus)

Platforms: Linux, Windows, MacOS, Android

Tools: VS Code, PyCharm, Colab, Visual Studio, Git, gdb, CMake, IntelliJ, Eclipse, KDevelop, Qt, Android Studio, Nsight, Tableau, Unity

Key Courses: Optimization for Deep Learning, Statistical Machine Learning, Probabilistic Machine Learning, Model-Based Image and Signal Processing, Digital Image and Signal Processing, Estimation Theory, Reinforcement Learning, Digital Control Systems Analysis

WORK EXPERIENCE

Research Assistant

West Lafayette, IN

Machine Intelligence & Networked Data Science (MINDS) Group, Purdue University West Lafayette

Aug 2025 – Present

- Advised by Prof. Abolfazl Hashemi on project “Learning through the Air: Cross-Layer UAV Orchestration for Online Federated Optimization” to design efficient algorithms with mathematical guarantees to render practical deployment of learning-based systems possible under a variety of considerations such as limited resources, robustness, and adversarial behaviors

Teaching Assistant

West Lafayette, IN

ECE Department, Purdue University West Lafayette

May 2022 – Aug 2025

- Hold office hours and help sessions, grade homework assignments and compose helpful materials for “ECE69500 Optimization for Deep Learning”, “ECE20001 Electrical Engineering Fundamentals I” and “ECE20002 Electrical Engineering Fundamentals II”

Research Assistant

West Lafayette, IN

Video and Image Processing Laboratory (VIPER), Purdue University West Lafayette

Aug 2021 – May 2022

- Advised by Prof. Edward J. Delp and Prof. Fengqing M. Zhu on projects: “Image Based Plant Phenotyping: The PhenoSorg Project”, and “Technology Assisted Dietary Assessment (TADA)”

Research Assistant

Hammond, IN

Center for Innovation through Visualization and Simulation (CIVS), Purdue University Northwest

Feb 2020 – May 2021

- Advised by Prof. Chenn Zhou, Prof. Bin Chen and Prof. Lizhe Tan on projects: “Smart Ladle: AI-Based Tool for Optimizing Casting Temperature” and “Structured Light Vision Systems”

PROJECT

Unveiling the Cycloid Trajectory of EM Iterations in Mixed Linear Regression

West Lafayette, IN

Machine Intelligence & Networked Data Science (MINDS) Group, Purdue University West Lafayette

May 2023 – Oct 2023

- Provided explicit closed-form expressions of EM updates in two-component Mixed Linear Regression (2MLR) under all SNR regimes
- Characterized the behavior of EM iterations and notably showed that all the iterations lie on a certain cycloid
- Exhibited theoretical estimate for the exponent of super-linear convergence and enhanced the statistical error bounds

Image Based Plant Phenotyping: The PhenoSorg Project

West Lafayette, IN

Video and Image Processing Laboratory (VIPER), Purdue University West Lafayette

Jan 2022 – May 2022

- Generated 1 thousand synthetic high-resolution UAV RGB images with panicle labels by using image-to-image translation GANs with a ground truth dataset of 400 real UAV RGB images
- Improved mean average precision with Intersection over Union from 0.5 to 0.95 (mAP[.5, .95]) for panicle detection task from 72% to 79%, and reduced Mean Absolute Percent Error (MAPE) for panicle counting task from 11.6% to 7.2%
- Worked on creating labels for panicles in PhenoRover RGB images to test our approach on data

Technology Assisted Dietary Assessment (TADA)

West Lafayette, IN

Video and Image Processing Laboratory (VIPER), Purdue University West Lafayette

Aug 2021 – May 2022

- Investigated reliable and effective methods for Fine-Grained Visual Classification (FGVC)
- Re-implemented a hierarchy-based embedding method for encoding of categories to decrease average hierarchical distance at top 1 by 3%, and that at top 5 by 10% on our VIPER-FoodNet dataset with 82 food categories, 15 thousand images
- Worked on improving the hierarchical method by incorporating the nutrient and visual information of food

Smart Ladle: AI-Based Tool for Optimizing Casting Temperature

Hammond, IN

Center for Innovation through Visualization and Simulation (CIVS), Purdue University Northwest

Feb 2020 – May 2021

- Developed a machine learning application using DNN, lightGBM to provide steel casting temperature predictions
- Reduced Root Mean Square Error (RMSE) of predicted casting temperature to 3 degrees Fahrenheit
- Collaborated application with SQL database and GUI using Unity (C#) to display predictions and parameters
- Tested and deployed this tool at Steel Dynamics Inc (SDI) Butler Division, awarded AIST 2022 Hunt-Kelly Outstanding Paper Award – third place (AIME) and AIST 2021 Digitalization Applications Technology Best Paper Award

Structured Light Vision Systems

Hammond, IN

Department of Electrical and Computer Engineering, Purdue University Northwest

Aug 2019 – May 2021

- Developed a framework for object height measurement using a structured light system with multiple cameras and multiple laser emitters whose Mean Absolute Percent Error (MAPE) reached 4%
- Proposed a Multi-level RANSAC method to tackle intersections of multiple lasers which decreased MAPE by 20%

Automated Fetal Brain Segmentation Using Deep Convolutional Neural Network

Hammond, IN

Department of Electrical and Computer Engineering, Purdue University Northwest

Sept 2018 – Jan 2019

- Labeled 6.7 thousand fetal brain slice images from coronal, transverse, and sagittal MRI scans from 30 to 33 weeks to be used for autonomous fetus brain registration
- Designed a U-Net based method with generative adversarial loss for automatic fetal brain segmentation, evaluated the performance with FPN, U-Net architectures and GAN loss, focal loss

Parking Occupancy Detection Using Computer Vision

Hammond, IN

Department of Electrical and Computer Engineering, Purdue University Northwest

Aug 2018 – May 2019

- Developed a software in Python (PyTorch) based on CNN to identify and count occupied parking spaces, whose accuracy reached 90%, precision was 96% on videos of parking spaces
- Incorporated the mutual information method for image registration and the affine transformation to eliminate the impact caused by camera shake and enhance the robustness of detection

PUBLICATIONS

- [1] **Z. Luo** and A. Hashemi. “Characterizing Evolution in Expectation-Maximization Estimates for Overspecified Mixed Linear Regression,” Preprint (under review), Submitted to *Transactions on Machine Learning Research (TMLR)*.
- [2] **Z. Luo** and A. Hashemi. “Unveiling the Cycloid Trajectory of EM Iterations in Mixed Linear Regression,” *Proceedings of International Conference on Machine Learning (ICML)*, July 2024.
- [3] E. Cai, **Z. Luo**, S. Baireddy, J. Guo, C. Yang, and E. J. Delp. “High-Resolution UAV Image Generation for Sorghum Panicle Detection,” *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*, June 2022.
- [4] N. J. Walla, **Z. Luo**, B. Chen, Y. Krotov, and C. Q. Zhou. “Smart Ladle: AI-Based Tool for Optimizing Caster Temperature,” *Proceedings of the Iron & Steel Technology Conference (AISTech)*, May 2021.
- [5] **Z. Luo**. “Structured Light Vision Systems Using a Robust Laser Stripe Segmentation Method,” Master thesis. Purdue University Graduate School, May 2021.
- [6] **Z. Luo**, Y. Zhang, and L. Tan. “Multi-Level Random Sample Consensus Method for Improving Structured Light Vision Systems,” *Proceedings of IEEE Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON)*, Oct 2020.
- [7] Y. Zhang, **Z. Luo**, J. Hou, L. Tan, and X. Guo. “Computer Vision Techniques for Improving Structured Light Vision Systems,” *Proceedings of IEEE International Conference on Electro Information Technology (EIT)*, Aug 2020.

PROFESSIONAL SERVICES

Journal and Conference Reviewers: IEEE Transactions on Signal Processing (TSP), International Conference on Machine Learning (ICML), Conference on Uncertainty in Artificial Intelligence (UAI), International Conference on Artificial Intelligence and Statistics (AISTATS), IEEE International Conference on Multimedia and Expo (ICME), Annual Conference on Vision and Intelligent Systems (CVIS)

Memberships: IEEE Young Professionals, IEEE Signal Processing Society, IEEE Computer Society

AWARDS AND HONORS

AIST 2022 Hunt-Kelly Outstanding Paper Award – third place (AIME)	2022
AIST 2021 Digitalization Applications Technology Best Paper Award	2021
Innovative Practice Outstanding Student (5%)	2019
National third prize of Energy Saving and Emission Reduction Social Practice and Technology Competition	2017
Honorable Mentioned prize of the Interdisciplinary Contest in Modeling (ICM)	2017
Second prize of Contemporary Undergraduate Mathematical Contest in Modeling (CUMCM)	2016
The Second Prize of the People’s Scholarship	2015 – 2017