Zhankun Luo

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Education

Purdue University West Lafayette — West Lafayette, IN
Ph.D. in Electrical and Computer Engineering GPA 3.95/4 — *Aug 2021 – Present*

Purdue University Northwest — Hammond, IN
Master in Electrical and Computer Engineering GPA 3.96/4 — *Aug 2019 – May 2021*

Beijing Institute of Technology — Beijing, China
Bachelor in Telecommunication Engineering GPA 85/100 — *Sept 2015 – Jun 2019*

Technical Skills

Programming: Python, C/C++, Java, SQL, C#, MATLAB, Assembly, Bash, LaTeX, HTML, Git, Cmake, Tableau, Unity
Frameworks: PyTorch, TensorFlow, Keras
Libraries: OpenCV, NumPy, Scipy, Matplotlib, scikit-learn, pandas, eigen3, Sophus
OS: Linux, Windows, MacOS
Developer Tools: PyCharm, VS Code, Colab, Visual Studio, IntelliJ, Eclipse, KDevelop, Qt, Android Studio, Nsight

Work Experience

Teaching Assistant — West Lafayette, IN
ECE Department, Purdue University West Lafayette — *May 2022 – Present*
- 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 on project "Smart Ladle: Al-Based Tool for Optimizing Casting Temperature"

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*
- Firstly provided explicit closed-form expressions for 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: Al-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. **"Unveiling the Cycloid Trajectory of EM Iterations in Mixed Linear Regression,"** Submitted to *International Conference on Machine Learning (ICML)*, July 2024.

[2] 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 (CVPR)*, June 2022.

[3] 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.

[4] **Z. Luo**. **"Structured Light Vision Systems Using a Robust Laser Stripe Segmentation Method,"** Master thesis. Purdue University Graduate School, May, 2021.

[5] **Z. Luo**, Y. Zhang, and L. Tan. **"Multi-Level Random Sample Consensus Method for Improving Structured Light Vision Systems,"** Proceedings of *2020 11th IEEE Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON)*, Oct 2020.

[6] Y. Zhang, **Z. Luo**, J. Hou, L. Tan, and X. Guo. **"Computer Vision Techniques for Improving Structured Light Vision Systems,"** Proceedings of *2020 IEEE International Conference on Electro Information Technology (EIT)*, Aug 2020.

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*

Professional Society

Reviewer for the IEEE Transactions on Signal Processing
Reviewer for the International Conference on Artificial Intelligence and Statistics (AISTATS 2024)
Reviewer for the IEEE International Conference on Multimedia and Expo (ICME 2022)
Reviewer for the Annual Conference on Vision and Intelligent Systems (CVIS 2021)
Reviewer for *Plant Methods* (online journal for the plant research community)
Member of IEEE Young Professionals, IEEE Signal Processing Society, and IEEE Computer Society
Member of Association for Iron & Steel Technology (AIST), and Material Advantage