# Kaiming Fu

## Ph.D. Candidate

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## Skills

**Programming Languages:** C++, Python, R, Matlab.
**Familiar with:** CUDA, Pytorch, Scikit-Learn and TensorFlow.
**Familiar with:** Neural Networks (YOLO, CNN, Fast RCNN, Faster RCNN, ResNet), SVM, Random Forest, etc.

## Education

**University of California, Davis** — **Davis, CA**
*Ph.D. in Electrical and Computer Engineering* — *Sep. 2019 - Present*
*Double-Major M.S in Statistics*
**GPA:** 3.92

**Purdue University, West Lafayette** — **West Lafayette, IN**
*M.S. in Mechanical Engineering* — *Jan. 2018 - May. 2019*
**GPA:** 3.77

## Research Experience

**Simulation Design and Optimization of Agricultural Robotics**
*CUDA, Helios, LiDAR*

- Designed a robot-tree-fruit simulation system, including the development of digital models and the research on object interference.
- Enhanced harvester design, assessed fruit collection efficiency, and optimized fruit quality through accelerated CUDA-based simulations and interference analysis.
- Employed RGB imagery, LiDAR, and IMU data for accurate fruit canopy localization, enhancing simulation realism.
- Optimized a planning algorithm for dynamic system utilizing visible fruit distributions derived from in-field computer vision data acquisition.

**Crop Counting Through Deep Learning Enhanced By Synthetic Images**
*Pytorch, YOLOv8*

- Created a dataset of RGB and NIR walnut images, manually annotated, and sourced from a multispectral camera.
- Generated synthetic images to enhance the walnut image set, addressing limitations arising from specific lighting conditions.
- Developed a YOLOv8 model for crop detection, leveraging multispectral imagery to surpass the constraints of using only RGB images.
- Improved F1 score with synthetic data: RGB detection $(11.4\%)$; NIR detection$(19.9\%)$; Multispectral detection$(13.8\%)$.

## Projects

**Annual Farm Robotics Challenge**
*Team Leader. Grand Prize Winner among National-wide Universities and Colleges* — *Feb. 2023 – May 2023*

- Designed a real-time harvesting assistant robot that autonomously follows human operators and transports harvested crops to storage, eliminating manual tractor transport.
- Enhanced robot's ability to monitor and offer real-time feedback on worker posture using a self-designed Human Monitoring System.

**"Inceptio-Tsinghua AIR Cup" Autonomous Driving Challenge**
*1st Prize Winner among 1067 Teams* — *Sep. 2022 – Dec. 2022*

- Utilized an Xbox controller to collect driving data for training a neural network with Imitative Learning, collaborating on semi-trailer acceleration control with the LCA lane keeping system.
- Employed a range of advanced problem-solving techniques, including two-way search, greedy algorithms, space pruning, convex optimization, and the deep reinforcement learning PPO algorithm.

**Fine-Grained Classification in Plant Pathology**
*IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR) workshop* — *Mar. 2021 – May. 2021*

- Preprocessed imbalanced dataset using a data sampler, employed ResNet50 as the baseline, achieving an F1 score of 0.70.
- Created an Attention Learning Network for accurate part localization within the classification pipeline.
- Implemented a Generative Data Augmentation model for image augmentation and training dataset balance.
- Improved F1 score to 0.874 using a UNet-ResNet generator and a DenseNet discriminator.

## Selected Publications

**Computer-aided Design and Optimization of a Multi-level Fruit Catching System for Soft Fruit Harvesting.**
*Kaiming Fu, Stavros G. Vougioukas, Brian N. Bailey. Computers and Electronics in Agriculture. Submitted.*
**Topological and Spatial Analysis of Within-tree Fruiting Characteristics for Walnut Trees.**
*Ying-Tsui Wang, Brian N Bailey, Kaiming Fu, Kenneth Shackel. Scientia Horticulturae. Aug. 2023.*
**The Probability Distribution of Absorbed Direct, Diffuse, and Scattered Radiation in Plant Canopies with Varying Structure.**
*Brian N. Bailey, Kaiming Fu. Agricultural and Forest Meteorology. Jul. 2022.*
**Test Set Optimization by Machine Learning Algorithms.**
*Kaiming Fu, Yulu Jin, Zhousheng Chen. 2020 IEEE International Conference on Big Data. Dec. 2020.*

## Selected Presentations

**Fusion-Driven Tree Reconstruction and Fruit Localization: Advancing Precision in Agriculture.** — **Detroit, Michigan**
*Poster Presentation at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) Workshop* — *Oct. 2023*
**Walnut Detection Through Deep Learning Enhanced by Multispectral Synthetic Images.** — **Detroit, Michigan**
*Poster Presentation at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) Workshop* — *Oct. 2023*
**Computer-aided Design and Optimization of a Shake-catch Soft Fruit Harvester.** — **Houston, Texas**
*Oral Presentation at American Society of Agriculture and Biological Engineers Annual International Meeting (ASABE)* — *Jul. 2022*