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.
- Developed a dynamic harvesting system based on visible fruit distributions obtained from the in-field 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 (0.806); NIR detection(0.745); Multispectral detection(0.863).

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 Imitative learning to generate training data for decision-making planning algorithms, employing an XBox controller to ensure accurate self-driving track creation for semi-trucks and sedans to reach target destinations.
- Developed an efficient decision-making algorithm for self-driving semi-trucks and sedans to navigate complex urban and highway environments collision-free.

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*