

# Siddhartha Bhattacharya

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## EDUCATION

### Michigan State University

*Bachelor of Science in Computer Science, Minor in Mathematics*

East Lansing, MI

Aug. 2021 – Present

## RESEARCH EXPERIENCE

### Research Assistant

*Food AI and Eng. Lab*

May. 2024 – Present

East Lansing, MI

- Improved the generalization accuracy of micro-colony classification models to out of distribution imaging conditions by 43% by implementing Domain Adversarial Neural Networks for robust domain adaptation. This model aligned the feature representation of all micro-colonies, regardless of imaging condition.
- Fine tuned pre-trained vision foundation models for classification of bacterial micro-colonies from microscopic images, sampled from several distributions of imaging conditions

### Research Assistant

*Robotics & Intelligent Vehicle Automation Lab*

Jan. 2024 – Present

East Lansing, MI

- Achieved 5mm mean apple localization accuracy for robotic apple harvesting, an 80% improvement from previous methods. Developed novel localization methods, fusing foundation models with unsupervised point clustering.
- Implemented compound AI systems for robotic perception, using late-stage fusion of vision-language models and segmentation foundation models to localize apples in 3D space.
- Integrated advanced multi-modal AI systems for robotic perception using ROS, speeding up developer efficiency.

### Byzantine-Robust Decentralized Federated Learning

Jan. 2024. – Apr. 2024

- Investigated Byzantine-secure aggregation strategies in distributed federated learning settings. Evaluated the effects of malicious attack on distributed training of large scale AI systems with over 100 devices.
- Implemented a decentralized federated learning framework with PyTorch and a simulation module to efficiently configure and run experiments of various network topologies, aggregation strategies, and attack methods.
- Impact of Network Topology on Byzantine Resilience in Decentralized Federated Learning; Bhattacharya, Helo, Siegel. Under Review – ACM Transactions on Modeling and Performance Evaluation of Computing Systems: Special Issue on Federated Learning*

## WORK EXPERIENCE

### Software Engineering Intern

*ZF North America*

May 2023 – Jan. 2024

Farmington Hills, MI

- Reduced software test case execution time for vehicular microcontrollers by 90% by developing a test automation framework with Embedded C and Python, streamlining the company QA process.
- Enabled QA developers to express test cases using natural language. Implemented RAG for large language models to generate test case configurations for our in-house automation framework based on product requirement documents.

## PROJECTS

### FedUp: A Decentralized Federated Learning System

Jan. 2024

- Engineered a novel distributed federated learning system enabling peer-to-peer learning collaboration with dynamic configuration of network topology. *Secured first place at SpartaHack 9.*
- Implemented the decentralized training network using PyTorch and TCP/IP to enable propagation of model updates through a modular network topology. Our approach outperformed centralized ML in both epochs to convergence and validation loss.

### Vice President, Autonomous Strawberry Pruning Robot

Jan. 2024. – Present

- Lead the perception team to train and integrate computer vision models for object detection and segmentation into an end-to-end strawberry-tending robot.
- Collaborated with peers to create a compact and autonomous pre-harvesting robot to tend to strawberry plants by identifying healthy plants and pruning unhealthy leaf clusters. The robot will compete at the 2024 ASABE International Meeting.

## SKILLS

Distributed Systems, Graph Learning, Computer Vision, Compound AI Systems, PyTorch, ROS, Flask