Yogesh Chawla

Robotics researcher focused on perception, multi-robot collaboration, and AI

Master's Candidate in Biological and Systems Engineering | University of Nebraska–Lincoln

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Education

Master of Science in Agricultural and Biological Systems Engineering ***GPA- 3.95/4.00***

University of Nebraska–Lincoln, Nebraska, United States ***2024-2026***

Minor in School of Computing

Integrated (B.Tech + M.Tech), Agricultural and Food Engineering ***CGPA-8.76/10***

Indian Institute of Technology, Kharagpur, India ***2019-2024***

B.Tech in Agricultural and Food Engineering
M.Tech in Financial Engineering
Micro-Specialization in Artificial Intelligence

Research Interests

Robotics, Computer Vision, Multi-Robot Collaboration, Sensor Fusion, Reinforcement Learning, Precision Agriculture and Agriculture Automation

Publications

Peer-Reviewed Journal Publications

J5 Muvva, V., **Chawla, Y.**, Joseph, K., Kalra, A., Wolf, M., Pitla, S. (2025). DLCL: Deep Learning-enabled Cooperative Localization for UAV-UGV Team with Adaptive Perception Recovery. ***International Journal of Computer Vision (IJCV)***. [Under Review]

J4 Muvva, V., Joseph, K., **Chawla, Y.**, Wolf, M., Pitla, S. (2025). Custom UAV with Model Predictive Control for Autonomous Static and Dynamic Trajectory Tracking in Agricultural Fields. ***Frontiers in Robotics and AI***. [Paper]

J3 Lavanya, V., Das, A., Nayak, A., **Chawla, Y.**, ... Chakraborty, S. (2024). Digital soil mapping of available phosphorus using a smartphone-integrated RGB imaging device and ascorbic acid extraction method. ***Smart Agricultural Technology***. [Paper]

J2 Rathore, D., Girija, D., Reddy, L., **Chawla, Y.**, Buragohain, M., et al. (2023). A Two-stage Deep-learning Model for Detection and Occlusion-based Classification of Kashmiri Orchard Apples for Robotic Harvesting. ***Journal of Biosystems Engineering***, 48:242-256. [Paper]

J1 Shukla, A., Roy, S., and **Chawla, Y.**, et al. (2023). From Goals, Waypoints Paths To Long Term Human Trajectory Forecasting. ***ReScience C Journal***, 15233-15242. [Paper]

Peer-Reviewed Conference Publications

C2 Maheshwari, P., Karhade, J*., **Chawla, Y***., ... Pitla, S., Wang, W., Scherer, S. (2025). AnyThermal: Towards Learning Universal Representations for Thermal Perception. ***IEEE International Conference on Robotics and Automation (ICRA 2026)***. [Under Review]

C1 Muvva, V., **Chawla, Y.**, Joseph, K., Wolf, M., Pitla, S. (2025). Cooperative Localization of UAVs in Multi-Robot Systems Using Deep Learning-Based Detection. ***AIAA SCITECH 2025 Forum***. [Paper]

Presentations without Publications

P3 **Chawla, Y.**, ... Pitla, S. (2025). Virtual Farm Environments and Sim-to-Real Transfer in Agricultural Robotics Using NVIDIA Omniverse. ***Oral Presentation at American Society of Agricultural and Biological Engineers Annual International Meeting 2025***. [Presentation]

P2 **Chawla, Y.**, Aggarwal, V., and Saraswat, D. (2022). Fine-tuning based approach for generalizing YOLOv4 network for Soybean detection in UAS images. ***Oral Presentation at American Society of Agricultural and Biological Engineers (ASABE) 2022***. [Presentation]

P1 Leguizamo, D., **Chawla, Y.**, ... Sarkar, S. (2022). Robotic Manipulation for Plant Interaction Using Reinforcement Learning. ***Workshop on Machine Learning for Cyber-Agricultural Systems (MLCAS) 2022***. [Abstract]

Research Projects

AnyThermal: Universal Thermal Perception Backbone *Aug 2025 – Present*

Prof. Wenshan Wang, Carnegie Mellon University (*Under Review at ICRA 2026*)

- Developed a robust **RGB–thermal alignment pipeline** using stereo depth back-projection from FoundationStereo model, enabling dense pixel-level registration across **16,943 synchronized RGB–T pairs**.
- Enabled **AnyThermal**, a DINOv2-based thermal backbone distilled from RGB, achieving **81.11% Recall@1**, **53.47% mIoU** (3.6× faster than RTFNet-152), and improved depth (**AbsRel 0.0883**).

Perception, Manipulation, and Swarm Coordination for Smart Agriculture *August'24 - Present*

Prof. Santosh Pitla, University of Nebraska–Lincoln

- Developing a **zero-shot sim-to-real deep reinforcement learning (RL) system** to **manipulate corn plants** using the **UFactory xArm6** robotic manipulator, aimed at detecting **corn stalk lodging**.
- Designing a **multimodal plant disease anomaly detection framework** leveraging **DINOv3** and **vegetation context** for early and robust disease identification under challenging field conditions.
- Developed a DL based **cooperative localization system** for **UAV–UAV** and **UAV–UGV**, improving **positional accuracy** by **1 m** over GNSS and achieving **74.0 mAP** with **52 ms** inference using **YOLOv8n**.
- Implemented a **reactive gap following algorithm** on a physical **F1Tenth autonomous vehicle**, leveraging LiDAR data to detect obstacles, create a safety bubble, and identify the largest gap in real time.

Digital Soil Phosphorus Mapping Using a Smartphone RGB Device *Aug'24 – Dec'24*

Prof. Somsubhra Chakraborty, IIT Kharagpur

- Processed and analyzed **482 soil samples** across six districts in West Bengal, performing image-based Phosphorus estimation (NP) and comparing against spectrophotometer (UV) measurements.
- Developed a **digital soil mapping (DSM) pipeline** using Random Forest regression with climate, vegetation, and USDA soil taxonomy as covariates to generate high-resolution spatial P maps.
- Implemented **generative models** (Gaussian Copula, TVAE, CTGAN) to handle high-P data imbalance, with Gaussian Copula giving best DSM performance ($\mathbf{R^2 = 0.73}$, **RMSE = 12.91 kg/ha**).
- Generated soil P spatial variability maps identifying **high-P alluvial zones** (Nadia, East Medinipur) and **low-P red/lateritic soils** (Birbhum, Jhargram), enabling region-specific nutrient management insights.

Garbage-IT: A Large Multimodal Dataset of Garbage Images and Text *May'23 - August'23*

Prof. Roberto Souza, University of Calgary (Abstract, Github)

- Developed a Garbage Classification System trained on **12,000 multimodal image and text data**.
- Implemented a **custom data loader** to efficiently integrate image and text data using the Pigeon library.
- Trained and evaluated **14 image models** and **5 NLP models**, identifying **EfficientNetV2-Medium** and **DistilBERT** as top performers, achieving **84.1%** and **90.5%** accuracy respectively.
- Designed a **multi-modal fusion model** reaching **91.3%** accuracy, improving performance by **0.8%**.

Autonomous Apple Harvesting Robot *August'22 - April'23*

Prof. Peeyush Soni, IIT Kharagpur (Github)

- Developed a **two-stage deep learning framework** for robotic apple harvesting, integrating **YOLOv7** for fruit detection and **EfficientNet-B0** for occlusion-based classification.
- Achieved a mean average precision **(mAP)** of **0.902** and **F1-score** of **0.905** with a detection speed of **0.128** s/image.
- Classified apples into four occlusion categories with an overall accuracy of **91.38%** aiding robotic planning.

Plant–Robot Interaction with RL and Multimodal Crop Canopy Data *May'22 - August'22*

Prof. Soumik Sarkar, Iowa State University (Github)

- Implemented **Reinforcement Learning (RL) to interact with plant (soft material) using robotic manipulation** using an open-source multi-physics simulation engine Chrono.
- Trained the RL agent by changing various parameters like **elastic constant, density, and gravity**.
- Investigated **Self Supervised** Fine Tuning **Multi-modal data fusion strategies** using the **MultiMAE** model on the crop canopy reflectance data (RGB, thermal and depth images) for calculating **wilting score** of the plants.
- Volunteered in the data collection process and collected RGB and multispectral imagery at Muscatine farm.

Undergraduate Researcher, AGV Research Group, IIT Kharagpur *March 2020- Present*

Prof. Debashish Chakravarty, IIT Kharagpur (Github)

- **Autonomous Ground Vehicle (AGV)** is a research group aimed at building a fully operational self-driving car working on varied projects involving Deep Learning, and Reinforcement Learning.
- Designed and modeled the **chassis of a 6-wheeled planetary rover** using **SolidWorks** for the **University Rover Challenge (URC)**, capable of performing diverse autonomous tasks.
- Led the **Deep Learning Trajectory Prediction** team, focusing on **multi-modal trajectory prediction**, and had our work selected for the **Machine Learning Reproducibility Challenge 2021–22**.

Technical Skills

Programming Languages/Libraries/Softwares: C, C++, Python, Numpy, Pandas, Matplotlib, Pytorch, MATLAB, Keras, Tensorflow, Scikit-Learn, OpenCV, Solidworks, ArcGIS, Webots, Gazebo, ROS, ROS2.

Reviewing Assignments

ASABE, IJCV, Smart Agricultural Technology (Elsevier)

Professional Organization Memberships

- American Society of Agricultural and Biological Engineers (ASABE)
- IEEE-Robotics and Automation Society (IEEE-RAS)

Teaching Experience

ASABE CPD Workshop: Developing Custom Autonomous UGVs and UAVs *July 2025*

- Served as a **co-instructor** for the ASABE CPD Workshop, guiding faculty and graduate students in **developing custom autonomous UGVs and UAVs from the ground up**.
- Taught **hands-on robot wiring, sensor integration, and hardware** for ground and aerial platforms.
- Led **programming and navigation sessions**, including **Arduino-based ultrasonic sensing, RealSense integration, and ROS Noetic indoor autonomy**.

Teaching Assistant, AGEN 892: Applied Robotics in Agriculture *Jan 2025–May 2025*

- Facilitated hands-on lab sessions on ground and aerial robots, guiding students on **ROS-based concepts**.
- Provided **technical support** with UGV/UAV hardware setups and software tools (**ROS2, Python**).
- **Led a team of 5 graduate students** to develop the **UFArm SwiftPro robotic manipulator** for **egg-picking automation**.

Teaching Assistant, BSEN 460: Instrumentation and Controls *Aug 2024–Dec 2024*

- Developed and led **hands-on LabVIEW and myDAQ lab sessions**.
- Provided **technical support and troubleshooting**, clarifying instrumentation concepts.
- Assessed student performance by **grading lab reports and delivering structured feedback**.

Team Lead, UNL Robotics Club *Aug 2024–May 2025*

- **Led a team of 6 students** in the construction and programming of a robot for the **ASABE competition**.
- Oversaw the integration of ROS 2-based navigation with **LiDAR and Intel RealSense sensor fusion**.
- **Managed project schedule and coordination** across mechanical, electrical, and software teams.

Awards and Scholarships

Nebraska Abroad: AI Robotics in Agriculture Program *October 2025*

- Selected for the cross-cultural technical exchange at **Osnabrück University of Applied Sciences, Germany**. Completed lectures and site visits with industry and research leaders (Agro-Technicum, Agrotech Valley Forum, CLAAS, and Nature Robots) on autonomous systems safety and agricultural robotics.

Graduate Student Travel Award *June 2025*

- Selected for the Graduate Student Travel Award by **University of Nebraska Lincoln**.

Larrick Student Travel Award *January 2025*

- Selected for the Larrick Student Travel Award by **University of Nebraska Lincoln**.

Institute Order of Merit *April 2024*

- Awarded by the Students' Gymkhana, IIT Kharagpur, for outstanding contributions to InterIIT events.

Mitacs Summer Research Scholarship *May 2023*

- Selected as Intern at the Department of Electrical and Software Engineering, **University of Calgary.**

Honda Young Engineer and Scientist's (Y-E-S) Award *January 2022*

- Selected for the **Honda Young Engineer and Scientist's (Y-E-S) Award** by the **Honda Foundation, Japan**, awarded annually to **14 students from IITs across India** for excellence in science and technology.

Vinod Gupta Leadership Scholarship *June 2022*

- Awarded with the Vinod Gupta Leadership Scholarship Award based on **leadership qualities** in the Department, Halls of Residence, and Campus activities during the tenure of first and second years.

Inter IIT Tech Meet 10.0, IIT Kharagpur *March 2022*

- Won a solo gold among the 23 participating IITs **Silicon Labs' High-Prep Social Entrepreneurship Challenge** in the 10th Inter IIT Tech Meet for an **IoT-based truck health monitoring system** idea.

Inter IIT Tech Meet 9.0, IIT Guwahati *January 2023*

- **Won gold** in Drishtee's tech-led Innovation for Rural Entrepreneurs event in the IIT Tech Meet 9.0 and made a platform for connecting Self Help Groups to Bulk Buyers by creating a network of Rural Producers.

Relevant Coursework

AI/CS Courses: Programming and Data Structures, Foundations of Artificial Intelligence, Software Engineering in Robotics, Advanced Machine Learning, Advanced Deep Learning, Statistics Foundation in AI and ML, Artificial Intelligence in Manufacturing, Cognitive Information Processing, Data Analytics, Image Processing.

Maths Courses: Regression and Time Series, Stochastic Processes, Partial Differential Equation, Linear Algebra.

AG Courses: Applied Robotics in Agriculture and Natural Resources, Embedded Controls and Systems in Agriculture, Digital Soil Mapping, AI Applications in Agriculture, Soil Science, Thermodynamics, Crop Science, Hydrology, Agricultural Machinery, Food Science, Tractor and Power Systems, Design of Machine Elements.

Volunteering and Leadership Experience

Sponsorship Team Head, Gopali Youth Welfare Society, IIT Kharagpur *July 2019 - December 2021*

- Gopali Youth Welfare Society is a registered voluntary **non-governmental organization** run by students of IIT Kharagpur which ensures socio-economic welfare of underprivileged sections of the society. Runs a school Jagriti Vidya Mandir (JVM) near the village of Gopali, focusing on providing good **quality free-of-cost education to 230 children**.
- Led the Sponsorship team and was responsible for planning and executing sponsorship-related events.

Undergraduate Department Representative, IIT Kharagpur *September 2023–May - 2024*

- Elected for the position of Undergraduate Department Representative for the **Department of Agricultural and Food Engineering**, IIT Kharagpur, for the academic session 2021-22.
- Worked as a member of the **Undergraduate Council (UG)** which acts as a liaison between students and administration to convey critical issues pertaining to academics and student welfare.