KULBIR SINGH AHLUWALIA

Website ◇ Google scholar ◇ GitHub

SUMMARY

Kulbir Singh Ahluwalia is a fourth-year PhD candidate in the Department of Computer Science at the University of Illinois at Urbana-Champaign, advised by Prof. Girish Chowdhary and Prof. Julia Hockenmaier. His research focuses on natural-language grounding for agricultural field robots, including navigation, remote recovery from robot navigation failures, and adaptive robot learning.

EDUCATION

Ph.D. in Computer Science, University of Illinois at Urbana-Champaign, USA (June 2022-Present), GPA: 3.91/4
M.Eng. in Robotics, University of Maryland, College Park, USA (Aug 2019-May 2021), GPA: 3.88/4
B.Tech. in Electrical Engineering, Punjab Engineering College, India (Aug 2015-May 2019), GPA: 8.12/10

RESEARCH PAPERS

- Cuaran, J.; **Ahluwalia, K.S.**; Koe, K.; Uppalapati, N.K.; Chowdhary, G. Active Semantic Mapping with Mobile Manipulator in Horticultural Environments. (Accepted to ICRA 2025) [Project Website] [arXiv PDF] [arXiv]
- Rangwala, M.; Liu, J.; **Ahluwalia, K.S.**; Ghajar, S.; Dhami, H.S.; Tracy, B.F.; Tokekar, P.; Williams, R.K. DeepPaSTL: Spatio-Temporal Deep Learning Methods for Predicting Long-Term Pasture Terrains Using Synthetic Datasets. Agronomy 2021, 11, 2245. (published in Agronomy as part of the Special Issue AI and Agricultural Robots) [Link to published paper] [PDF]
- Liu, J.; Rangwala, M.; **Ahluwalia, K.S.**; Ghajar, S.; Dhami, H.S.; Tracy, B.F.; Tokekar, P.; Williams, R.K. "Intermittent Deployment for Large-Scale Multi-Robot Forage Perception: Data Synthesis, Prediction, and Planning", 2021. [arXiv] [PDF] (published at IEEE TASE, Transactions on Automation Science and Engineering)

EXPERIENCE

Earthsense Inc., Urbana, IL, USA *May 2025-Present*
Position: AI Intern
Contact: Michael McGuire, Lead Computer Vision Engineer, Earthsense, Urbana, IL, USA

- Developing a natural language conditioned waypoint generation pipeline for 2D and 3D motion planners for enhancing outdoor robot navigation.
- Created an automatic labeling pipeline for large outdoor robot navigation datasets using Grounded SAM2, streamlining data processing.
- Deployed and integrated open-source Visual Language Models (Molmo-7B-demo, Gemma-3-27B, and Qwen-2.5-VL-72B, Qwen3-30B, Llama4-Scout, Spatial-VLM) for robot reasoning in image space and open-world natural language instruction conditioned question answering for 4 wheeled skid steer outdoor robots.

University of Illinois, Distributed Autonomous Systems Lab, Hockenmaier Lab *Aug 2022-present*
Graduate Research Assistant
Mentors: Dr. Girish Chowdhary & Dr. Julia Hockenmaier

- U 3D, dynamic, semantic representations for objects and grounded 3D voxel value maps for the robot's environment.
- Categorized and collected manual recovery action sequences for failure cases arising from visual occlusions, sensor noise, and mechanical failures.
- Constructed topological maps from Rosbags for Visual language navigation and grounding using IMU, GPS, and RGB camera images.

TECHNICAL SKILLS

Languages	Python, MATLAB, C++
Analysis & Design	Simulink, Blender, AutoCAD, Solidworks, Ultimaker Cura, Adobe Premiere Pro
Libraries	PyTorch, Transformers, Numpy, Pandas, OpenCV, SciPy
Other	ROS, Gazebo, RViz, CUDA, Linux, Docker, Git, Doxygen, Anaconda, LaTeX

PROJECTS

- **SLAM from 2D LiDAR data using split and merge line extraction algorithm** [GitHub]
- **State estimation using Extended Kalman Filter for GPS+IMU+Encoder sensor fusion** [GitHub]
- **Processed data from RTK-GPS, IMU and encoders to plot trajectory of a field robot** [GitHub]
- **Autonomous Vaccine Delivery Robot** [GitHub]
- **Image segmentation using superpixels** [GitHub]
- **Persistent-Monitoring using Multi-Robot (UAV-UGV) Coordination** [GitHub]
- **Optimized a GestureGAN for resource-constrained settings** [GitHub]
- **Self-adjusting roadmaps** - Navigation in unknown environments using LD-PRM [GitHub]
- **Estimated the motion of a car using Visual odometry** [GitHub]
- **AR-Tag detection** - superimposed an image and virtual cube on an AR tag [GitHub]
- **Tracked moving objects using Lucas-Kanade Tracker** [GitHub]
- **Lane detection and Turn prediction for self-driving car** [GitHub]
- **Agile Robotics for Industrial Automation Competition (ARIAC) 2019** [Drive]
- **Teleoperated gesture-controlled robotic arm** [GitHub]