KULBIR SINGH AHLUWALIA

Website ◇ Google Scholar ◇ GitHub
Urbana, Illinois, USA ◇ ksa5@illinois.edu

SUMMARY

Ph.D. candidate in Computer Science at UIUC with expertise in robotics, computer vision, and natural language processing. Experienced in deploying Visual Language Models for robot perception, developing semantic mapping systems, and building end-to-end autonomous navigation pipelines. Proven track record of translating research into practical applications with 3 published papers and successful industry internship at Earthsense.

EDUCATION

Ph.D. in Computer Science, University of Illinois at Urbana-Champaign [2022-Present], GPA: 3.91/4.0
M.Eng. in Robotics, University of Maryland, College Park [2019-2021], GPA: 3.88/4.0
B.Tech. in Electrical Engineering, Punjab Engineering College, India [2015-2019], GPA: 8.12/10.0

EXPERIENCE

AI Intern - Earthsense Inc., Urbana, IL *[May 2025 - Aug 2025]*
- Developed natural language waypoint generation pipeline improving robot navigation success by 35%
- Deployed 6 Vision-Language Models on edge devices achieving 82% spatial reasoning accuracy
- Built automatic labeling pipeline using Grounded SAM2 processing 10,000+ images

Graduate Research Assistant - UIUC *[Aug 2022 - Present]*
- Developing 3D semantic voxel maps achieving 92% success in robot failure recovery
- Fine-tuned CodeT5 model for natural language to robot control with 78% accuracy
- Processed 100+ hours of Rosbag data for topological mapping using CLIP

Lead Instructor - CS498GC Mobile Robotics, UIUC *[Fall 2024, **Fall 2025 (Current)**]*
- Taught ROS2, SLAM, and sensor fusion to 60+ students per semester
- **Designed and built course website:** https://kulbir-singh-ahluwalia.com/cs498gc/fa25/ and developed autograding infrastructure

Teaching Assistant - CS444 Deep Learning for CV, UIUC *[Spring 2024, 2025]*
- Guided 150+ students through assignments: CNNs (AlexNet/ResNet), object detection (YOLO/R-CNN), Vision Transformers
- Debugged PyTorch implementations, gradient flow issues, GPU optimization, and custom loss functions

PUBLICATIONS

- [**ICRA 2025**] Cuaran, J.; **Ahluwalia, K.S.**; et al. Active Semantic Mapping with Mobile Manipulator in Horticultural Environments
- [**IEEE TASE**] Liu, J.; Rangwala, M.; **Ahluwalia, K.S.**; et al. Intermittent Deployment for Large-Scale Multi-Robot Forage Perception
- [**Agronomy 2021**] Rangwala, M.; Liu, J.; **Ahluwalia, K.S.**; et al. DeepPaSTL: Spatio-Temporal Deep Learning for Pasture Terrain Prediction

TECHNICAL SKILLS

Languages	Python, C++, MATLAB, JavaScript, Bash
ML/AI	PyTorch, TensorFlow, Transformers, Hugging Face, JAX
Computer Vision	OpenCV, YOLO, SAM2, CLIP, Open3D, PCL
Robotics	ROS/ROS2, Gazebo, MoveIt, SLAM, Navigation Stack
Tools	Docker, Git, CUDA, Linux, LaTeX, Weights&Biases

SELECTED PROJECTS

- **Stereo Depth Enhancement** - Outperformed SOTA models by 46% using diffusion [Poster]
- **SLAM from 2D LiDAR** - 0.2m localization accuracy [GitHub]
- **Extended Kalman Filter** - Multi-sensor fusion with 0.5m accuracy [GitHub]
- **Autonomous Vaccine Robot** - 95% delivery success [Video]
- **Neural Dependency Parser** - 91% UAS on Penn Treebank [GitHub]
- **Image Segmentation** - 98% accuracy with SLIC superpixels [GitHub]
- **GestureGAN Optimization** - 5.7 parameter reduction with MobileNet
- **A* Path Planning** - Non-holonomic Turtlebot3 navigation [GitHub]
- **ARIAC 2019** - 90% order fulfillment with UR10 arms
- **Gesture-Controlled Robot** - Web-based teleoperation [GitHub]

ACHIEVEMENTS

- **National Bal Shree Award** in Creative Scientific Innovations - Conferred by President of India
- First Prize in B.Tech Major Project - "Teleoperated Gesture Controlled Robotic Arm" [2019]
- First Prize at IIT Roorkee, 6th/400 at IIT Bombay - Robotics Competitions [2016]
- First Prize, Texas Instruments Hardware Hackathon - "Smart Garden" [2017]