Rajat Arora

Toronto, ON | +1 (647) 649-5062 | arora24rajat@gmail.com | Rajat Arora | Rajat-Arora

Education

University of Toronto — Toronto, Canada
Master of Engineering in Aerospace Engineering — *Dec. 2025 – Present*

Thapar Institute of Engineering and Technology — Patiala, India
Bachelor of Engineering in Mechatronics Engineering — *CGPA: 9.81/10 Gold Medal*

Position of Responsibility & Experience

Mobile Robotics Engineer, Addverb Technologies, India — Sep. 2023 – Nov. 2025

- Developed C++ hardware drivers for real-time control of motor parameters (velocities, torques), PLC communication, and BMS using EtherCAT, CAN, and Modbus protocols.
- Developed a **Python utility for automatic dataset labeling for bounding boxes and segmentation**, ensuring data integrity for supervised AI model training.
- Implemented 3DOF pallet pose estimation leveraging deep learning and point cloud processing for precise docking; validated results using internal datasets and simulation.
- Implemented multi-sensor state estimation (LiDAR, IMU, wheel odometry) using non-linear optimization for robust localization in dynamic environments.
- Trained a **semantic segmentation model for obstacle detection using synthetic data** and monocular cameras; deployed point cloud generation for enhanced navigation.
- Authored kinematic libraries and global planners with motion primitives for swerve and tricycle AMR models.

Embedded Robotics Intern, Cartrack, Singapore — Dec. 2022 – Sep. 2023

- Integrated GPS into IMU-based odometry using an Invariant Extended Kalman Filter (IEKF) with pseudo-measurement models formulated for car motion constraints.
- Utilized **Deep Learning (CNNs)** for the dynamic adaptation of covariance noise parameters, improving state estimation accuracy under variable sensor noise.
- Implemented core algorithms in **C language** for optimized deployment on resource-constrained embedded devices.

Executive Board, Mechatronics and Robotics Society - MARS — June 2021 – June 2022

- Guided a team of **90+ members** on mobile robotics concepts, focusing on C++, OOP, and concurrent programming for real-world robotics projects.

Junior Engineer, Addverb Technologies - Production — June 2019 – July 2020

- Managed production planning and created Standard Operating Procedures (SOPs) to ensure data integrity and operational efficiency in factory environments.
- Provided design improvements for warehouse automation projects via assembly drawing analysis and proof-of-concept coordination.

Projects

Morla (Hardware Project) | *SLAM, Navigation, Teensy, PID, ROS, Sensor fusion* | — April '22

- Built a plug-n-play mobile platform for point-to-point navigation, mapping, and LIDAR odometry; performed extensive PID tuning and wheel odometry calculation.
- **Future Work:** Integrating LIDAR-Inertial fusion and visual sensors for VIO and Visual SLAM.

Path Planning Visualizer | *C++, Python, Data Structures, Boost.Python* | — Jan '22

- Implemented BFS, Dijkstra, and A* Algorithms from scratch in C++; used Boost.Python for high-performance interoperability between C++ planners and Python GUIs.

Robotics Simulation | *SLAM, NavigationStack, AMCL, EKF, Gazebo, RViz* | — Jan-May '21

- Simulated autonomous navigation, 3D mapping (RTABMap), and ball-chasing robots using color detection; integrated camera and sensor models in URDF/Gazebo.

Competitions & Achievement

International Rover Challenge | *Emerging Team of the Year Award* | 🌐 Dec '23

- Designed a rocker-bogie suspension and robotic arm mechanisms; optimized mobility for human-machine interaction in unstructured terrain.
- Trained YOLOv8 for arrow bounding box detection and directional tracking using IMU-based orientation data for autonomous navigation.

Academics

- Awarded **Gold Medal** (Branch Topper) and Merit Scholarships (Top 10%) for the B.E. program at Thapar University; recipient of Best Capstone Project award at ISTC.

Technical Skills

Languages: C++, Python (NumPy, Pandas), MATLAB, C
AI & Deep Learning: PyTorch, TensorFlow, CNNs, LSTMs, Transformers.
Robotics & Tools: ROS/ROS2, Gazebo, Eigen3, OpenCV, State Estimation (EKF/IEKF), Control Theory, Docker, Git.
Soft Skills: Documentation of Functional Specifications, Analytical Problem Solving, Technical Communication.

Relevant Coursework

Undergraduate Coursework

Data Structures; OOP; Autonomous Systems; Image Processing; Linear Algebra; Machine Learning; Optimization.

Online Specializations

Robotics Software Developer, Deep Learning, and C++ Nanodegrees (Udacity); F1Tenth (UPenn).