RITIKA GHOSH

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EDUCATION

Northwestern University **Evanston, IL**
Master of Science in Robotics *Sep 2022 – Sep 2023*
Courses: Embedded Systems in Robotics, Machine Dynamics, Robotic Manipulation, Sensing Navigation and Machine Learning, Active Learning in Robotics, Introduction to Artificial Intelligence, Computer Vision, Machine Learning

Thapar Institute of Engineering and Technology **Patiala, India**
Bachelor of Science in Mechatronics Engineering *Aug 2017 – Jul 2021*
Courses: Control Systems, Signals & Systems, Digital Signal Processing, CAD, Mechanics of Machine

SKILLS

Programming: C++, Python, C, Java, ARM, MATLAB/Simulink, Unit Testing, Linux, Docker, Bash
Software/Libraries: ROS2/ROS, PyTorch, Tensorflow, OpenCV, Gazebo, Rviz, Foxglove, MoveIt!, Git, Bitbucket
Robotics: Computer Vision, Machine Learning, Motion Planning, AI, SLAM, Robotic Manipulation
Mechanical/Hardware Design: SolidWorks, AutoCAD, Eagle, Microcontrollers, 3D Printing, Prototyping

WORK EXPERIENCE

Stanley Black & Decker OUTDOOR **Indiana, US**
Robotics Software Engineer (Commercial Autonomous Team) *Oct 2023-May 2024*
- Developed a Model Predictive Controller from scratch in ROS2 for a commercial autonomous lawn mower prototype.
- Tested the MPC module on the unit and in gazebo simulation to achieve a precision of approx 2.5 cm in path tracking.

Siemens Industry Software Pt. Ltd **Gurgaon, India**
Simulation and Design Intern *Jan - Jul 2020*
- Collaborated with a team developing digital twin simulations of a manufacturing plant in NX CAD software.
- Developed programmable logic controller (PLC) programs in TIA portal software for industry 4.0 applications.

Thapar Institute of Engineering and Technolo **Patiala, India**
Research Assistant *Jan 2019 -Jun 21*
- Performed a comparative study by designing, simulating, and analyzing bone drilling modules in Abaqus software.
- Tested the drillbit in simulation while observing thermal and vibrational impacts on the bone with varying frequency.

SELECTED PROJECTS

Deep Reinforcement Learning for Shared Autonomy in Pytorch & Tensorflow:
- Implemented a constrained residual PPO algorithm to assist the Franka arm reach a goal in OpenAI gym environment.
- Trained a 3 layer neural network behavior cloning agent as a human surrogate policy to control the end effector.

Machine Learning for Hand Motion Imitation in Python and C++:
- Developed a ROS 2 package utilizing OpenCV and mediapipe's machine learning framework for hand tracking.
- Designed visual feedback system for teleoperating a 4-finger, 16-DOF robot hand to perform grasping tasks.

Franka Robot Playing Air Hockey:
- Collaborated with a team of 4 to program a 7 DOF industrial arm to autonomously play air hockey in python ROS 2.
- Tracked a sliding puck by applying OpenCV and predicted its trajectory path with the help of Intel RealSense D435.
- Developed Python API for MoveIt! 2 for inverse kinematic computation in cartesian space motion planning.

Extended Kalman Filter from Scratch:
- Programmed a ROS 2 SLAM package in C++ implementing the Extended Kalman Filter (EKF) from scratch.
- Developed C++ library for 2D kinematics and odometry of differential drive robots, including testing modules.
- Implemented unsupervised learning-based landmark detection and data association for cylindrical objects and walls.

Autonomous Quadrotor Control from Scratch in C:
- Developed a PID and user control for a multi-DOF quadrotor, integrating a Raspberry Pico with an onboard IMU.
- Achieved autonomous flight and position maintenance in space using a vive IR sensor.

Design and Fabrication of an Autonomous Mobile Robot:
- Built an electronics subsystem for a line following Mobile Robot in C++, incorporating IR and Ultrasonic sensors.
- Programmed it to sense obstacles and reroute around multiple cars on the path with wireless Zigbee communication.