Vaibhav Raheja

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Education

University of Illinois Urbana-Champaign — **Champaign, IL**
M.Eng Autonomy and Robotics GPA: 3.77 — *Graduation Date: December 2024*

NMIMS' MPSTME — **Mumbai, India**
B.Tech Computer Engineering — *June 2023*

Work Experience

Intelligent Motion Laboratory — **Champaign, IL**
Research Developer — *August 2023 - December 2023*

- Implemented advanced facial detection and analysis techniques using FaceMesh, OpenFace 1.0, and DeepFace for a robotic eye exam, alongside head pose estimation with ZED camera's depth tracking, to enhance the accuracy and effectiveness of facial feature detection in various scenarios.
- Engineered and simulated a robotic arm, focusing on optimizing camera placement for effective 3D mapping, thereby improving the precision of face detection and head pose estimation for comprehensive eye examinations.

All India Institute of Medical Sciences (AIIMS) Hospital — **Mumbai, India**
Research Developer — *February 2021 - May 2023*

- Collaborated with a robotics team to develop and execute an innovative intubation research project, sponsored by the Indian Council of Medical Research (ICMR), resulting in a 20% increase in procedural accuracy.
- Designed a custom catheter and mouthpiece integrated with a camera system, contributing to successful intubation, with a 'xArm 5' robotic arm.

Projects

Intelligent Ground Vehicle Competition (IGVC)

- Led a multidisciplinary team as captain of Team D.A.R.V.I.N for an international robotics competition in Detroit.
- Secured 2nd and 3rd place in the Cyber and Auto-Nav Challenge categories, demonstrating our capabilities in autonomous navigation using lane and object detection with GPS navigation.

Autonomous Race Car

- Implemented path planning for autonomous navigation on Formula 1 racetracks in the CARLA simulator using Hybrid A*, Spline Interpolation, and Dynamic Programming
- Integrated a Proportional-Derivative (PD) controller with Pure Pursuit and longitudinal controller for steering and speed control to follow the trajectory.

Reinforcement Learning using Dog Robot

- Applied reinforcement learning to enhance Unitree Go1 robot control, to surpass factory controller in adaptability and task efficiency.
- Executed real-world testing of RL models, optimizing robotic responsiveness and navigation precision in unstructured environments.

Dish Washing Using a Dual Arm Robot

- Developed and fine-tuned YOLOv9c-based object recognition to accurately identify plated for robotic manipulation.
- Implemented motion planning protocols with MoveIt, facilitating precise dish transfer by a dual-arm robot in automated household tasks.

Skills

Programming: Python, C++, Robot Operating System (ROS), Gazebo, OpenCV, PyTorch, Machine Learning (ML), Convolutional Neural Networks (CNN)

Tools: Autodesk Fusion 360, Computer-Aided Design (CAD), Linux, Git, Arduino, Raspberry Pi, 3D Printing

Frameworks: Path Planning, Vehicle Control, Reinforcement Learning, Control Algorithms, Motion Planning Algorithms

Publications

Raheja, Vaibhav et al. (Nov. 2022). "Multi-Disease Prediction System using Machine Learning". In: *International Conference on Futuristic Technologies (INCOFT)*. URL: https://ieeexplore.ieee.org/document/10094382.