Vaibhav Raheja

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PROFESSIONAL EXPERIENCE

Intelligent Motion Laboratory Aug 2023 – Dec 2023
Robotics Research Intern Champaign, USA

- Developed facial detection and analysis techniques using FaceMesh, OpenFace 1.0, and DeepFace for a robotic eye exam, enhancing accuracy by 28% and implementing head pose estimation with ZED camera depth tracking for 35% improved precision.
- Designed and simulated a robotic arm with optimized camera placement, increasing detection accuracy by 22% and reducing untracked frames by 18%, while using Fusion 360 for custom setups to ensure optimal facial coverage.

All India Institute of Medical Sciences (AIIMS) Hospital Feb 2021 – May 2023
Robotics Research Intern Mumbai, India

- Led an ICMR-sponsored intubation research project, driving a 20% increase in procedural accuracy through advanced robotic techniques and machine learning algorithms.
- Designed a custom catheter and mouthpiece with an integrated high-resolution camera system, enhancing intubation success rates and patient safety through real-time visualization, using the 'xArm5' robotic arm.

EDUCATION

University of Illinois Urbana-Champaign Aug 2023 – Dec 2024
Master's of Engineering Autonomy and Robotics GPA: 3.66/4 Champaign, USA

Mukesh Patel School of Technology Management & Engineering Jul 2019 – Mar 2023
Bachelor of Technology in Computer Engineering GPA: 3.66/4 Mumbai, India

PROJECTS

Benchmarking Control Algorithms for Unitree Go1 Robot 2024
Python, ISAAC Sim, RL

- Enhanced Unitree Go1 robot control through reinforcement learning, achieving 20% higher average speeds on challenging terrains and surpassing factory controller in adaptability.
- Executed real-world testing of RL models, optimizing robotic responsiveness and navigation precision, resulting in a 30% reduction in velocity tracking error compared to baseline models.

Dish Washing Using a Dual Arm Robot 2024
Python, ROS, Gazebo, Pose Estimation, Motion Planning

- Developed a simulation-based automated robotic system for loading dishes into a dishwasher using Gazebo, implementing a dual-arm robot (MOMO) positioned in front of a simulated kitchen sink.
- Explored various pose estimation techniques and implemented a sampling-based strategy for gripper pickup locations, overcoming challenges in algorithm compatibility and precision to achieve successful trajectory planning.

Autonomous Race Car 2023
Python, Path Planning, Vehicle Control, CARLA Simulator

- Implemented path planning algorithms for autonomous navigation on a Formula 1 racetrack in the CARLA simulator, utilizing Hybrid A*, Spline Interpolation, and BFS, achieving a maximum score of 92.4 on the Shanghai track.
- Integrated a PD controller with Pure Pursuit and longitudinal control, reducing collisions and optimizing path planning techniques to achieve a 40.8% improvement over baseline scores.

Intelligent Ground Vehicle Competition (IGVC) 2019 – 2023
Python, ROS, OpenCV, PID Control, Path Planning, CAD

- Led a team as captain in an international robotics competition, developing SOCRATES 2.0 with innovations like central drivetrain design achieving an average speed of 2.4 km/h.
- Secured 2nd and 3rd place in Cyber and Auto-Nav Challenge categories, implementing autonomous navigation with lane and object detection combined with GPS, achieving over 95% navigation accuracy.

SKILLS

Programming: Python, C++, OpenCV, PyTorch, Machine Learning (ML), Convolutional Neural Networks (CNN)

Robotics Frameworks and Tools: Robot Operating System (ROS/ROS2), Gazebo, Path Planning, Vehicle Control, Reinforcement Learning, Control Algorithms, Simultaneous Localization and Mapping (SLAM)

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

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 . Nov 2022