Saptadeep (Sapta) Debnath

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Work Experience

Horizon Surgical Systems — Los Angeles, CA, USA
Sr. System Integration Engineer — *Oct 2024 - Present*

- Developed image-guided control algorithms, including image-based cataract surgery trajectories for a serially linked manipulator, robot path planning, and visual servoing for tool alignment.
- Implemented image-based safety monitoring algorithms and performed verification and validation (V&V) through integration testing and performance benchmarking.
- Integrated software modules across multiple Polaris subsystems, identified and fixed integration issues, and ensured reliable end-to-end system behavior.
- Led system-level testing of image-guided surgical robotic platforms by creating test plans, running structured experiments, and analyzing failure cases.
- Built testing and visualization tools, added unit and integration tests, and migrated a Python-based motion planner to C++ for production deployment.
- Participated in internal technical design and code reviews for safety-critical robotics software.

Equipment Technologies, Inc. — Mooresville, IN, USA
Robotics Software Engineer — *Mar 2021 - Sept 2024*

- Project in charge of the L3 Autonomy System for agricultural machines.
- Deployed a CNN semantic segmentation network that predicts crop rows for a J1939 CAN machine steering; achieved a 45% increase in f-score and 67% in IOU scores.
- Built an end-to-end ROS pipeline from scratch, establishing a flow of messages from prediction - motion planning - steering control manager. Optimized the code to realize a 30% reduction in latency rate.
- Designed and executed comprehensive V&V plans, including rigorous field tests on the Apache machine under real-world conditions to validate software performance.
- Mentored interns and junior engineers, offering valuable training and insights into computer vision algorithms and ROS fundamentals.

Skills Summary

- **Concentration Areas**: Motion Planning, Robotic System Design, Control Systems, Machine Vision, Deep Learning
- **Tools and Technologies**: C++, Python, ROS, OpenCV, PyTorch, NVIDIA Jetson, 2D/3D Cameras
- **Leadership Experience**: Project Lead @ ET Works (2021 - 2024), Team Lead @ IFOR - UAV Team (2016 - 2018)

Education

University of Michigan — Ann Arbor, MI, USA
Master of Science in Electrical and Computer Engineering (Robotics specialization) — *2019 - 2020*

BITS, Pilani – Dubai Campus — Dubai, UAE
Bachelor of Engineering in Electronics and Communication Engineering — *2014 - 2018*

Patents

- **Navigation system for agricultural machine**: US20250151639A1; WO2025099494A2
- **AI-Guided Robotic Tool Insertion for Cataract Surgery**: Patent Pending
- **Telerobotic Ophthalmological Surgery Feedback and Trajectory Planning through Persistent, Real-Time Anthropomorphic 3D Eye Model**: Patent Pending

Publications

- **Design and Development of a Non-Linear Controller for Quadrotor type Unmanned Aerial Vehicle**: IEEE International Conference on Inventive Computation Technologies. Authors: Saptadeep Debnath and Mary Lourde R (Coimbatore, India) (link)
- **Image-based Biomechanical Case study of an International Archer**: International Conference on Sports Engineering. Authors: Saptadeep Debnath and Subir Debnath (Jaipur, India) (link)
- **Visual Odometry Data Fusion for Indoor Localization of an Unmanned Aerial Vehicle**: IEEE International Conference on Power, Control, Signal & Instrumentation Engineering. Authors: Saptadeep Debnath and Jagadish Nayak (Chennai, India) (link)

Honors and Awards

- **Winners, Drones for Good University Challenge**: Issued by Mohammed Bin Rashid Space Centre and Government of Dubai
- **2nd Place, International Space Settlement Design Competition**: Issued by NASA Ames Research Center