Saptadeep Debnath

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Work Experience

- **Equipment Technologies, Inc.** — Mooresville, IN, USA
  Robotics Engineer — *Mar 2021 - Present*
  - Led the Vision-Based Advanced Driver Assisted System initiative as the Product Owner, driving product innovation and improving operational efficiency.
  - Developed and deployed an advanced CNN-based semantic segmentation network that predicts crop rows for CAN-linked machine steering; achieved a 45% increase in f-score and 67% in IOU scores.
  - Created a robust advanced ROS architecture pipeline, establishing a seamless flow of messages from prediction software to steering control manager; optimized operations and reduced response time, resulting in enhanced system performance and efficiency.
  - Conducted rigorous field tests to validate software performance under real-world conditions.
  - Mentored a summer intern, providing valuable training and insights into machine learning algorithms and ROS fundamentals.
  - Spearheaded the company's IP generation efforts by conducting research on existing patents, drafting new claims, and ensuring comprehensive protection of intellectual property rights.
- **Fulda University of Applied Sciences** — Fulda, Germany
  Research Intern — *Feb 2018 - Jul 2018*
  - Explored LSTM network performance by adjusting datasets and built a ROS pipeline to control a robot with 98% accuracy via real-time freehand gestures.

Skills Summary

- **Concentration Areas**: Robotic System Design, Machine Vision, Deep Learning, Control Systems
- **Programming Languages**: C/C++, Python, Bash, HTML
- **Tools and Technologies**: Robotic Operating System (ROS), OpenCV, PyTorch, NVIDIA Jetson, Machine Vision Cameras

Education

- **University of Michigan** — Ann Arbor, MI, USA
  Master of Science in Electrical and Computer Engineering (Robotics specialization) — *Sept 2019 - Dec 2020*
- **BITS, Pilani – Dubai Campus** — Dubai, UAE
  Bachelor of Engineering in Electronics and Communication Engineering — *Sept 2014 - May 2018*

Academic Projects

- **Object Tracking for Safety**: Engineered an object tracking module to detect and conclude the distance of the moving object from the camera; issued warnings based on the object's proximity to the camera.
  Tech: YOLO, DeepSORT, RGB-D (November '20) (link)
- **Slam and Path Planning implementation on MBot**: Explored and implemented advanced mapping, path planning, and motion control algorithms for a differential drive robot simulation model.
  Tech: C++, IMU, 2D LIDAR, SLAM, A-star, path planning (April '20) (link)
- **Invariant Extended Kalman Filtering for Robot Localization using IMU and GPS**: Developed an Invariant EKF-based localization system and conducted comparative analysis with Extended Kalman Filter-based localization system and a GPS-alone dataset.
  Tech: MATLAB, In-EKF, IMU, GPS (April '20) (link)
- **6-DOF Serial Link Robotic Manipulator**: Produced a Python codebase for autonomous operation of serially connected motors, integrating object detection using a Kinect camera suite to facilitate efficient pick-n-place operations.
  Tech: Python, manipulators, objection detection, OpenCV, path planning-smoothing, state machines (March '20) (link)
- **Mobile Inverted Pendulum System**: Designed a cascaded control architecture for a two-wheeled robot, achieving balance and autonomous navigation along pre-defined trajectories.
  Tech: C, inverted pendulum, trajectory following, IMU, PID, Beaglebone, Robot Control Library (February '20) (link)
- **Hand Gesture Control of a Robot using Intelligent Techniques**: Created a ROS pipeline enabling real-time free hand gesture translation to motion instructions for a TurtleBot, powered by an Intel Atom processor.
  Tech: ROS, C++, Python, RNN, TensorFlow, SLAM, TurtleBot (July '18) (link)

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 - November '18) (link)
- **Image-based Biomechanical Case study of an International Archer**: International Conference on Sports Engineering. Authors: Saptadeep Debnath and Subir Debnath (Jaipur, India - October '17) (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 - September '17) (link)