Saptadeep (Sapta) Debnath

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Work Experience

- **Equipment Technologies, Inc.** — Mooresville, IN, USA
  Robotics Software Engineer — *Mar 2021 - Present (3+ years)*
  - 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.
  - Patent Generation: Collaborated with the company's patent attorney to research existing patents, draft new claims, and ensure comprehensive protection of intellectual property rights. **(Patent pending US18/506,867)**

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 - Present), 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*

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)

Honors and Awards

- **Winners, Drones for Good University Challenge**: Issued by Mohammed Bin Rashid Space Centre and Government of Dubai, Nov 2015
- **2nd Place, International Space Settlement Design Competition**: Issued by NASA Ames Research Center, Apr 2012