Pranay Mathur

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RESEARCH INTERESTS AND SKILLS

Computer Vision, Deep-Learning, Robot Operating System, C++, Python, PyTorch, TensorFlow, OpenCV, Linux, MATLAB, Github, Java, LATEX

EDUCATION

M.S Robotics	Georgia Institute of Technology		**Aug 2022 – 2024 (Exp.)**
B.E Electronics and Instrumentation	BITS Pilani, K.K Birla Goa Campus	CGPA 8.87/10 (Dept. Rank 3)	**Aug 2017 – July 2021**

EXPERIENCE

Engineering Development Group Intern — The MathWorks, Natick, MA **May 2023 – Aug 2023**

- Added features to the Simulink Test Toolbox scheduled for release in MATLAB & Simulink R2024a
- Improved performance of features in the toolbox achieving a 20% speed-up over original time
- Worked on the front-end of a project which ranked 2nd of 100 teams in a company-wide Hackathon

Developer — Google Summer of Code **June 2022 – Aug 2022**

- Built a path-finding algorithm for an **autonomous vehicle** using **Efficient-Det** architecture and **mapped landmarks** exploiting known camera intrinsics and landmark geometry
- Ported Efficient-Det to TFlite and **improved inference** speed to **22 FPS** on a Raspberry Pi using Coral Edge TPU

Graduate Engineer Trainee — Addverb Technologies, Noida **Aug 2021 – July 2022**

- Worked on **appearance-based Navigation** of ground-based robots using semantic-scene understanding
- Integrated autonomous mobile-robots with **5G cloud-control** based capabilities using web-sockets and ROS
- Deployed system for augmenting LiDAR based **SLAM** and executing **recovery behaviour** in mobile robots

Intern — Technoyantra, Pune **Jan 2021 - Aug 2021**

- Developed a **localization algorithm** using EKF based fusion of pose estimates from **fiducial tags** and particle-filter based LIDAR SLAM

Undergraduate Researcher — University of Nevada, Reno, USA **July 2020 - Jan 2021**

- Developed a generalizable Resource-Aware algorithm for deployment of **Visual Inertial Odometry** algorithms on computationally constrained aerial vehicles under the guidance of **Prof. Kostas Alexis**
- Released and maintain two packages in ROS and ROS2 incorporated into ROS-perception and presented the work as a **Lightning Talk** at **ROS-World 2020**

Technical Intern — KPIT Technologies, Pune **May 2020 - July 2020**

- Worked on **multi-modal sensor fusion** based Object Detection using 3D LIDAR, monocular camera and a RADAR which **improved detection** performance upon occlusion and low illumination for **self-driving cars**

Research Intern — CSIR Central Electronics Engineering Research Institute, Pilani **May 2019 - July 2019**

- Implemented RTAB-Map **SLAM** for Autonomous Navigation of Quadcopters using PX4 and ROS in **visually-degraded GPS denied** environments using an RGBD camera
- Implemented multi-modal sensor fusion and visual noise-removal using classical image processing

PUBLICATIONS

Sparse Image based Navigation Architecture to Mitigate the need of precise Localization in Mobile Robots
Pranay Mathur, Rajesh Kumar, Sarthak Upadhyay - arXiv, 2022

Resource-aware Online Parameter Adaptation for Computationally-constrained Visual-Inertial Navigation Systems
Pranay Mathur, Nikhil Khedekar, Kostas Alexis - IEEE-RAS International Conference on Advanced Robotics, 2021

A Generalized Kalman Filter Augmented Deep-Learning based Approach for Autonomous Landing in MAVs
Pranay Mathur, Yash Jangir, Neena Goveas - IEEE International Symposium of Asian Control Association on Intelligent Robotics and Industrial Automation, 2021

Multi-Sensor Fusion-Based Object Detection Implemented on ROS
Pranay Mathur, Ravish Kumar, Rahul Jain - Springer International Conference on Machine Learning and Autonomous Systems, 2021

BCI Controlled Quadcopter using SVM and Recursive LSE Implemented on ROS
Kshitij Chhabra, **Pranay Mathur**, Veeky Baths - IEEE International Conference on Systems, Man and Cybernetics, 2020

AWARDS AND POSITIONS OF RESPONSIBILITY

Best Paper Award - IEEE IRIA, **Mantra Innovator of the Year** - CEL, BITS Goa, **Prof. Suresh Ramaswamy Memorial Award** - BITSAA International, **Teaching Assistant** – Computer Vision, Principles of User Interface Software, Signals and Systems, Microelectronic Circuits

COURSES

Deep-Learning, Data Structures and Algorithms, Object Oriented Programming, Microprocessors and Interfacing, Digital Image processing, Signals and Systems, State Estimation and Localization for Self-Driving Cars, Linear and Non-Linear Control Systems

PROJECTS

Human-Motion Prediction: With great power comes great res-pose-ability (GitHub) (Report) **Jan 2023 – May 2023**

- Worked on Transformers and Convolutional Seq-to-Seq models for human-motion prediction on computationally-constrained systems implemented in PyTorch
- Achieved comparable performance to several baselines implemented in the fairmotion library at reduced computational costs

Drone Delivery Using SLAM and Object Avoidance (GitHub) **May 2019 - July 2021**
Faculty Advisor: Dr. Sarang C. Dhongdi, Assistant Professor, Dept. of EEE

- Developed an algorithm for autonomous navigation of drones in GPS-denied environments using RTAB- Map V-SLAM and an RGBD camera
- Developed custom computer vision algorithms using CNN based attention maps for obstacle recognition and avoidance implemented in Tensorflow and OpenCV
- Selected for funding by the EEE Dept. and Sandbox Fabrication Lab, BITS Goa

Autonomous Landing of MAVs using a Kalman Filter and Faster-RCNN (Paper) **Jan 2021 - July 2021**
Faculty Advisor: Prof. Neena Goveas, Associate Dean & Prof. BITS Goa

- Developed an algorithm for autonomous landing of MAVs exploiting transfer learning to eliminate the need for fiducial markers on landing sites
- Used the Faster-RCNN architecture implemented in Tensorflow along with a Kalman Filter based controller deployed using the PX4 stack and mavros

Drone Control using Brain Wave Mapping (GitHub) (Paper) **Dec 2018 - July 2021**
Faculty Advisor: Dr. Veeky Baths, Associate Professor, BITS Goa

- Fabricated a BCI based Quadcopter using SVM classification and Recursive LSE
- Worked with Processing3, Python, Emotiv, Robot Operating System (ROS), mavros
- Received the prestigious Prof. Suresh Ramaswamy Memorial Award

Human Machine Teaming — DRDO **Jun 2018 - Apr 2019**
Faculty Advisor: Prof. Neena Goveas, Associate Dean and Prof. BITS Goa

- Contributed to a project on Human Machine Teaming and swarm robotics for the Defence Research and Development Organization (Certificate)
- Simulated a mission-plan involving a swarm of quadcopters on RotorS
- Deployed using ROS (Robot Operating System), Python, RotorS and Gazebo

Project Kratos – Mars Rover (LinkedIn) (GitHub) **Dec 2017 - Jun 2019**
Faculty Advisor: Dr. Toby Joseph, Dept. of Physics, BITS Goa

- Contributed in building a Mars Rover that ranked 10th of 25 teams in the Indian Rover Challenge
- Lead the communication sub-system and implemented a scheduling algorithm to transmit multiple camera and data feeds with minimal latency
- Set up Communication Networks using the Ubiquiti Networks Platform and automated processes using BASH scripting in Linux

Stabilisation of UAVs using Gyroscope and Accelerometer (GitHub) **Dec 2017 - Jun 2018**

- Implemented a PID controller using gyroscope and accelerometer data from an IMU for stabilization of aircraft in adverse operating conditions
- Used an MPU 6050 Inertial Measurement Unit and an Arduino Mega 2560 microcontrollers