

Pranay Mathur

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SKILLS AND RESEARCH INTERESTS

Computer Vision, Deep Learning, PyTorch, TensorFlow, NumPy, C, C++, Python, Java, CUDA, OpenCV, OpenMP, ROS, MATLAB, Linux, Github

EDUCATION

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

EXPERIENCE

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

- Integrated features into Simulink Test Toolbox scheduled for **release** in MATLAB and Simulink R2024a version
- Optimized C++ and MATLAB **back-end** performance achieving a **70% speed-up** over original execution time
- Built a JavaScript front-end for a project which ranked 2nd of 100+ teams in the company-wide hackathon

Google Summer of Code — Open-Source Developer | Remote June 2022 – Aug 2022

- Used **3D multi-view geometry** and Object Detection to predict landmark coordinates for path-finding in scale cars
- Implemented **model compression** using weight quantization of EfficientDet network to **improve inference** speed on a Raspberry Pi **accelerated** with a Coral Edge TPU.

Addverb Technologies — Graduate Engineer Trainee, Mobile Robotics | India Aug 2021 – July 2022

- Prototyped appearance-based navigation using **semantic-scene understanding** and **ML for image retrieval**
- Integrated autonomous mobile-robots (**AMR**) monitoring and control with cloud capabilities over 5G networks
- Deployed a system for augmenting LiDAR based **SLAM** and executing recovery behaviour in mobile robots

TechnoYantra (acquired by Acceleration Robotics) — Intern | Remote Jan 2021 - Aug 2021

- Developed a **localization** algorithm using Extended Kalman Filter (EKF) for **fusion of pose estimates** from fiducial tags and **particle-filter** based LiDAR **SLAM** for robot deployment in healthcare institutions and warehouses

Autonomous Robots Lab, UNR— Undergraduate Researcher | Remote 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 ROSCon 2020**

KPIT Technologies — Technical Intern | India May 2020 - July 2020

- Implemented **CNN based multi-modal sensor fusion** for object detection using 3D LiDAR, monocular RGB camera and a RADAR on occlusion and low illumination in self-driving cars

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

- Implemented RTAB-Map **SLAM** for **Autonomous Navigation of Quadcopters** using PX4 and ROS in GPS denied and **visually-degraded** environments using an **RGB-D** camera
- Implemented **non-linear optimization** based multi-sensor fusion and **probabilistic noise removal** for vision frontend

PUBLICATIONS

Proactive Human-Robot Interaction using Visuo-Lingual Transformers and Object Interaction Graphs

Pranay Mathur – IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), *Geriatrics Workshop*, 2023

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 (Best Paper Award)

Pranay Mathur, Yash Jangir, Neena Goveas - IEEE International Symposium of ACA 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, BITSAA, **Prof. Suresh Ramaswamy Memorial Award for Best Project**- BITSAA International, **Teaching Assistant** – Computer Vision, Principles of User Interface Software, Signals and Systems, Microelectronic Circuits

COURSES

Computer Vision, Deep Learning, Data Structures and Algorithms, Object Oriented Programming, Microprocessors, Digital Image Processing, Signals and Systems, State Estimation and Localization for Self-Driving Cars, Linear and Non-Linear Control Systems, Advanced Programming Techniques

PROJECTS

Long-Horizon Imitation Learning by watching Human Play Data

Aug 2023 – Present

Faculty Advisor: Dr. Danfei Xu, Assistant Professor at Georgia Tech and Research Scientist at NVIDIA AI

- Working on building reinforcement learning algorithms to advance SOTA in robot **policy learning** through human demonstration and **behaviour cloning**
- Trained baseline methods and built a transformer-based architecture implemented on a bimanual robotic platform

Long-Horizon planning of Next-best-view of NeRFs

Aug 2023 – Present

Faculty Advisor: Dr. Danfei Xu, Assistant Professor at Georgia Tech and Research Scientist at NVIDIA AI

- Working on building novel algorithms to perform sparse reconstruction of neural radiance fields across diverse data sets.
- Implementing multiple baselines and test infrastructure to evaluate and compare our proposed approach

Human-Motion Prediction: With great power comes great res-pose-ability ([GitHub](#)) ([Report](#))

Jan 2023 – May 2023

Faculty Advisor: Dr. Zsolt Kira, Assistant Professor at the School of Interactive Computing

- 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 accelerated by TensorRT 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 based classification and Recursive Least Square Estimation for robust control
- Built framework using Processing3, Python, Emotiv, Robot Operating System (ROS), and the PX4 flight control stack
- Received the prestigious Prof. Suresh Ramaswamy Memorial Award for the project

Human Machine Teaming — DRDO ([Certificate](#))

Jun 2018 - Apr 2019

Faculty Advisor: Prof. Neena Goveas, Associate Dean and Prof. BITS Goa

- Contributed to a project on Human- Machine collaboration and swarm robotics for the Defence Research and Development Organization
- Simulated a mission-plan involving a swarm of quadcopters on RotorS and implemented it using
- 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 Inertial Measurement Unit (IMU) for stabilization of aircraft in adverse operating conditions
- Used an MPU 6050 Inertial Measurement Unit and an Arduino Mega 2560 microcontroller