

# Pranay Mathur

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## EDUCATION

M.S Robotics (AI and Perception)	Georgia Institute of Technology	GPA 3.90/4	Aug 2022 – May 2024*
B.E Electronics and Instrumentation	BITS Pilani, K.K Birla Goa Campus	GPA 8.87/10 - Dept. Rank 3	Aug 2017 – July 2021

## EXPERIENCE

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

- Developed, integrated and tested features into Simulink Test Toolbox scheduled for release in MATLAB and Simulink R2024a version
- Optimized C++ and MATLAB back-end of the toolbox achieving a 70% speed-up over original execution time in a particular feature
- Developed JavaScript front-end for a project voted best product idea and ranked 2<sup>nd</sup> 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 project landmark coordinates for path-finding in a 1:10 scale autonomous car
- Implemented model compression using weight quantization of the EfficientDet network to improve inference speed on a Raspberry Pi accelerated with a Coral Edge TPU

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

- Prototyped appearance-based navigation using spatio-temporal LSTM for semantic-scene understanding and efficient image retrieval
- Deployed ML based solution for image retrieval and Visual-Place Recognition (VPR) to augment SLAM and delocalization recovery
- Integrated autonomous mobile-robots (AMRs) monitoring and control infrastructure with cloud capabilities for low-latency teleoperation

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

- Developed Extended Kalman Filter (EKF) based solution for fusion of pose estimates from fiducial tags and LiDAR based SLAM
- Built a module for human-tracking and following using YOLO architecture for detection and a Kalman filter for tracking waypoints

### 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 achieving a reduction in average CPU usage of upto 50%
- Released two official ROS and ROS2 perception packages - a ROS wrapper for Open3D and example use-cases with pointclouds
- Contributions selected for presentation as a Lightning Talk at ROSCon 2020 and are part of official ROS-Perception repositories

### KPIT Technologies — Technical Intern | India May 2020 – July 2020

- Developed CNN based multi-modal sensor fusion architecture for object detection using 3D LiDAR, RGB camera and RADAR
- Improved object detection performance in self-driving cars in low illumination, adverse weather conditions and partial occlusions

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

- Implemented RTAB-Map SLAM for Autonomous Navigation of Quadcopters in visually-degraded and GPS denied environments
- Implemented tightly-coupled multi-sensor fusion from inertial data and pose estimates from SLAM using factor-graph back-end

## SKILLS

PyTorch, TensorFlow, NumPy, C, C++, CMake, Python, Java, Bash, CUDA, OpenCV, OpenMP, ROS 1/2, MATLAB, Linux, Github

## PUBLICATIONS

**Proactive Human-Robot Interaction using Visuo-Lingual Transformers and Object Interaction Graphs** (*Best Paper Award*)  
Pranay Mathur – Geriatrionics Workshop - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023

**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 (ICAR), 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 (IRIA), 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 (ICMLAS), 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 (SMC), 2020

## 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

- 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 estimation for next-best view planning using uncertainty for sparse reconstruction in neural radiance fields in several datasets
- Implementing multiple baselines that use entropy-driven information gain 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 &amp; 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 10<sup>th</sup> 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

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**AWARDS AND POSITIONS OF RESPONSIBILITY****Best Paper Award** – IEEE/RSJ IROS'23 – Geriatrics Workshop**Best Paper Award** - IEEE IRIA '21**Mantra Innovator of the Year** – CEL/BITSAA International '20**Prof. Suresh Ramaswamy Memorial Award for Best Project**- BITSAA International '19**Teaching Assistant** – Deep-Learning, Computer Vision, Principles of User Interface Software, Signals and Systems, Microelectronic Circuits

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**COURSES**

Advanced 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, Deep-Learning for Robotics, Advanced Programming Techniques