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	GPA 8.87/10 - Dept. Rank 3	**Aug 2017 – July 2021**

EXPERIENCE

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

- Developed, tested and integrated features into Simulink Toolbox scheduled for release in MATLAB and Simulink version R2024a
- Optimized C++ and MATLAB back-end of the toolbox achieving a 70% speed-up over original execution time in a particular feature

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 quantized EfficientDet to improve inference speed on an embedded PC with an 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

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 inference performance for ADAS in low illumination, adverse weather conditions, seasonal changes 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

Neural Visibility Field for Uncertainty-Driven Active Mapping
Shangjie Xue, Jesse Dill**, Pranay Mathur,** Frank Dellaert, P. Tsiotras, Danfei Xu – IEEE/CVF Computer Vision and Pattern Recognition (CVPR), 2024

Proactive Human-Robot Interaction using Visuo-Lingual Transformers and Object Interaction Graphs *(Best Paper Award)*
Pranay Mathur – Geriatronics 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

- Working on advancing SOTA in generalizable egocentric robot manipulation policies using behaviour cloning with play data based planners
- Implementing manipulator agnostic representations for ego-trajectory prediction to serve as high-level planners in hierarchical policies

Long-Horizon planning of Next-best-view of NeRFs **Aug 2023 – Nov 2023**
Faculty Advisor: Dr. Danfei Xu, Assistant Professor at Georgia Tech and Research Scientist at NVIDIA AI

- Worked on visibility-based uncertainty quantification in Neural Radiance Fields (NeRF) applied to active mapping
- Implemented pose optimization pipeline and active mapping baselines 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

- Implemented transformers and Convolutional Seq-to-Seq models for human-motion prediction on computationally-constrained systems
- 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

AWARDS AND POSITIONS OF RESPONSIBILITY

Best Paper Award – IEEE/RSJ IROS'23 – Geriatronics 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

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