# Abhishek Iyer *Robotics, Perception and Machine Learning*

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## OBJECTIVE

**I am driven to increase disaster relief and environmental preservation efforts by deploying teams of autonomous robots in hazardous and dynamic environments by making robots a trustworthy and friendly part of our society.**

## EDUCATION

**Carnegie Mellon University,** *Masters in Robotics Systems Development* 08.2024 – 05.2026 | Pittsburgh, USA

- ***GPA:*** *4.25/4.00*
- **Capstone project:** Developing real-time 3D reconstruction and human detection capabilities through dense smoke to provide firefighters and emergency responders with the necessary information. Mentored by *AirLab and Prof. Sebastian Scherer*
- **Sensors and Compute:** VLP, TI Radar, FLIR Boson (stereo thermal), Stereo RGB (Zed), IMU, RTK GPS, Nvidia Jetson Orin
- **Courses:** Advanced Computer Vision; Learning for 3D Vision; Multimodal Machine Learning; Robot Autonomy; F1/10th Autonomous Driving; Deep Reinforcement Learning;

**BITS Pilani,** *B.E Electrical and Electronics* 08.2018 – 05.2022 | Pilani, India

- Bachelor Thesis: Human detection using Airbone Optical Sectioning for Forest Search and Rescue

## PUBLICATIONS OF NOTE

**[1] Eformer: Edge Enhancement based Transformer for Medical Image Denoising - ICCV '21 Workshop**

**[2] Ensemble Learning for Human Emotion Recognition using EEG Recordings - Multimedia Tools and Applications '23**

**[3] CoColor: Interactive Exploration of Color Designs - ACM IUI '23**

## PROFESSIONAL EXPERIENCE

**AirLab at Carnegie Mellon University,** *Team Lead* 08.2024 – present | Pittsburgh, USA

*Advisor: Prof. Sebastian Scherer*

- Perceiving and mapping indoor environments through **dense smoke** in real-time to provide critical information to firefighters.
- Detecting humans and open doors to provide rich information with **no extra manpower using an autonomous drone**.
- **Accelerating monocular depth estimation** models on hardware to recover metric depth in real-time using weight pruning, distillation, and frameworks like Nvidia TensorRT.
- Exploring **multi-spectral odometry** to provide reliable state estimation in dense smoke through fusing sensors like thermal cameras, IMU, and RGB cameras.
- Designing various electrical components like a power distribution board, battery monitoring system, and onboard image processing capabilities to enable real-time autonomy.

**Indian Institute of Sceince (IISc),** *Research Assistant* 11.2023 – 07.2024 | Bangalore, India

*Advisor: Prof. Rajiv Soundararajan*

- Explaining and preventing **biases and artifacts** introduced by **generative models** in AI generated images.
- Researched cross-modal representations in **vision-language models** to assess high-level semantic issues in AI-generated images
- Designed a multi-stream architecture leveraging **cross-attention** for fusing unimodal representations (prompts and images)
- Achieved **implicit alignment** using **contrastive and triplet loss** to enhance semantic coherence in representations
- Researched 3D reconstruction for a sparse set of images by using **Neural Radiance Fields (NeRFs).**

**Design.AI,** *Founding Software Engineer* 08.2022 – 08.2023 | Helsinki, Finland

- Delivering **brand and accessibility adherance** by rectifying UI/UX brand guideline infractions in real-time through a Figma Plugin.
- Automatically digitized 100+ brand guidelines for design teams at 5+ MNCs by encoding context into latent action space through **Large Language Models (LLMs)**.
- Created dataset for **detecting** design components and **grounding** digitized guidelines using CNNs and Vision Transformers.
- Tackled layout and accessibility guidelines by acting on relevant components through the latent action space.
- Contributed over 25% of the **Intellectual Property** developed at Design.AI
- Created tight client-centric feedback loops for long-term systems design.

**Aalto University,** *Research Assistant* 08.2021 – 08.2022 | Helsinki, Finland

*Advisor: Prof. Antti Oulasvirta*

- Enabling **automatic rapid prototyping** of UI designs with **adherence to accessibility guidelines**.
- Implemented **saliency and gaze estimation** techniques for extracting color palettes from heatmaps identifying focal points.
- Developed **MMCQ, MCTS, and GMMs** for sampling, searching a large space, and clustering for extraction of colour palettes.
- Designed 5 heuristics for color assignment to uncolored UI ensuring accessibility compatibility and color harmony.

**Johannes Kepler University,** *Bachelor Thesis* 07.2021 – 12.2021 | Linz, Austria

- State-of-the-art results for **search and rescue** by detecting humans and tracking **through dense forest canopies**.
- Reconstructed objects of interest by collecting numerous images from various positions to combine into **integral images computationally**, thus suppressing strong occlusions ("X-Ray" through obstacles).

- Achieved **real-time** performance by discarding **~85%** of false proposals using Reed-Xiaoli Detector as a heuristic for anchor generation.

## PROJECTS

**Computer Vision Research Society (CVRS),** *Co-Founder and Team Lead*
- Significantly reduced risk to patients by **denoising** low-dosage computed tomography (CT) scans.
- Achieved **state-of-the-art** results by enhancing edge detection using Sobel operators, encoder-decoder, and residual learning.
- Our work got accepted at the International Conference for Computer Vision (ICCV 2021 Workshop).

**Emotion classification from EEG signal analysis,** *Worked under Dr. Shishir Maheshwari and Dr. Rishi Raj Sharma*
- Designed various features from raw electroencephalography (EEG) data and a novel architecture for emotion classification.
- Demonstrated capabilities of ensemble architectures by achieving **state-of-the-art performance on the SEED dataset.**
- The semester-long project was converted into a manuscript and submitted to the Multimedia Tools and Applications Journal.

**Evolutionary techniques for manipulation of Robotic arm,** *Worked under Dr. Meetha Shenoy*
- Optimized for time taken, energy spent, and throughput in order to achieve more efficient solutions for factory automation.
- We utilized the Robot Operating System (ROS) to implement a **genetic evolution-driven movement algorithm** for 2 arms**.**

**AcYut,** *Embedded systems and electronics engineer*
- AcYut is a technical team that develops **autonomous humanoid robots** to compete in the RoboCup and RoboGames.
- My role was centered on the electronics module - researching and designing our **programmable motors** and **motor controllers** from scratch.

## COMMUNITY ENGAGEMENT

**Building Washrooms -** We noticed a lack of washrooms in the neighbourhood areas of our school from where some of the support staff came from. We took it upon ourselves to build fully functioning washrooms and provide a basic facility which should be a human right.

**Heal** - I was a core member of the Heal organization for a year. We focused on organizing shows and events, playing games, evocative storytelling and creating a buddy system at a children's cancer hospital.

**Tees ka Dum** - I spent two years being part of Tees ka Dum, doing community outreach in nearby areas. Our efforts were directed towards educating underprivileged kids - primarily using hands-on learning techniques to teach maths and science, awakening curiosity through demonstrations. Furthermore, we taught basic English so these kids could overcome communication barriers in higher education venues.

**Prabhat** - Spending time at Prabhat was probably the most touching and grounding experience for me. We worked closely with differently abled children and their parents, to learn more about their conditions. We designed and created visual and mobility aids that enabled easier communication between these children and their parents.

**Elder Homes** - I also spent a year organizing visits and planning sessions at elder homes. We hosted games, listened to their life stories, and commemorated the time we spent with them by creating a book with recipes and wisdom from the elders we spent time with.

## SKILLS

**Technical Skills -**
- *Languages:* Python, C, C++, Matlab, Arduino
- *Tools and Frameworks:* PyTorch, Tensorflow, Linux, ROS2, NumPy, Pandas, Matlab, OpenCV, Cuda, Hugging Face, Git, Gazebo, Eagle, Jira

## LEADERSHIP ROLES

**Team Founder**
- Proposed an **impactful project with immediate application** to PIs at the AirLab at Carnegie Mellon Uniersity.l
- Systematically broke down complex goals into achievable milestones and used those to **pitch and form** a well-suited team.

**Team Leader and Co-Founder,** *Computer Vision Research Society*
- Co-founded the Computer Vision Research Society at BITS Pilani to enable aspiring researchers to **solve computer vision problems that matter**.
- Proposed research directions, conducted relevant literature reviews, and **analyzed overarching research themes** with the team.

**Core Member,** *Department of Sponsorship and Marketing, BOSM*
- My responsibilities included allocating tasks, pitching, **negotiating with industry professionals,** and mentoring freshmen to secure sponsorship for the inter-collegiate sports festival at BITS Pilani.

## PERSONAL INTERESTS

Street Photography, Travelling, Watching Motorsports, Driving & Roadtrips, Hiking, Stargazing