

# Akash Karthikeyan

Student Researcher

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## Education

### University of Waterloo

Master of Applied Science (MASc) in Electrical and Computer Engineering,  
Pattern Analysis and Machine Intelligence (PAMI)

Waterloo, CA

Sep. 2023 - Sept. 2025

### Thiagarajar College of Engineering

Bachelor of Mechanical Engineering

Madurai, IN

Jun. 2019 - May. 2023

Thesis Title: Instant Depth Aware Reconstruction and Grasp Planning for Transparent Objects

Advisor: Prof. S. Saravana Perumaal

CGPA : 9.16/10.00

Government Aided (Autonomous) Institution and affiliated to Anna University, India

## Research Interest

Robotics Perception | Multi-Agent Robotic Systems | Optimal Control | Neural Radiance Fields | Motion Forecasting/ Path Planning

## Awards and Honors

Sep. 2023	<b>Scholarship:</b> Vector Scholarship in Artificial Intelligence	Ontario
Feb. 2023	<b>Honorary Title:</b> Best Outgoing Student - BE Mechanical Engg.	Madurai
May. 2022	<b>Fellowship:</b> MITACS GRI	Toronto
Nov. 2021	<b>Contest:</b> Winner in India Academia Connect AI Hackathon	India
Nov. 2021	<b>Contest:</b> Kaggle Competitions expert - <b>Ranked 282 globally!</b>	India
Aug. 2020	<b>Honorary Title:</b> Tamil Nadu Student Innovator	Chennai
Jun. 2018	<b>Honorary Title:</b> Young Environmental Scientist	Chennai
2017, 2018	<b>Honorary Title:</b> Student of the Year	Chennai

## Publications

- [1] Akash Karthikeyan, Robert Ren, Yash Kant, Igor Gilitschenski “AvatarOne: Monocular 3D Human Animation” *WACV, 2024* [\[Link\]](#)
- [2] Tianshu Kuai, Akash Karthikeyan, Yash Kant, Ashkan Mirzaei, Igor Gilitschenski “CMM: Building Category Agnostic and Animatable 3D Models from Monocular Videos” *CVPRW, 2023* [\[Link\]](#)
- [3] Akash Karthikeyan, Saravana Perumaal Subramanian. “Automated Annotation and Classification of Catheters in Chest X-Rays” *International Conference on Computer, Communication, and Signal Processing, 2022* [\[Link\]](#)

## Research Experience

### MITACS Research Intern

Intelligent Systems Lab, University of Toronto

Toronto, CA

Feb. 2022 - Present

• **Guide:** Prof. Igor Gilitschenski

- Proposed a template-free method [1] for building animatable 3D models for arbitrary types of articulated and deformable objects from a collection of monocular videos, which allows users to animate reconstructed objects in 3D for content creation
- Proposed end-to-end human avatar creation and w/ reposing and novel view rendering application
- Language grounded pose generation and animation
- Use of COLMAP and other off-shelf SfM based approaches to initialize camera poses and optimize the same with the feature correspondences
- **Keywords:** NeRF □ Neural Blend Skinning □ Camera pose optimisation

### Student Researcher

Vision Systems Lab, TCE

Madurai, IN

Feb. 2020 - Present

• **Guide:** Prof. S. Saravana Perumaal

- Depth/3D Shape estimation of objects using multi-view posed RGB images
- Obtain system information and camera poses of videos based on the learned correspondences.
- Reconstruct the same in CAD and allow future redesigning from scans
- Implementation of SLAM + RRT based approaches for autonomous navigation in GPS denied regions rendered the experiments with the help of AIRSIM and ROS Wrapper
- **Keywords:** SLAM □ Motion Forecasting □ Physics and Social Aware Trajectory Generation [\[Link\]](#)

## Yukta Racing

Lead Steering Sub-system

Madurai, IN

Jun. 2020 - May. 2022

- **Faculty Coordinator: Prof. A. Samuel Raja**
- Developing Numerical G-G diagram for design parameter exploration and to better understand vehicle dynamics (primarily on cornering - avoiding oversteer via adjusting lateral grip)
- Design and Manufacture with high degree of precision for the following components: steering wheel, steering column tie rod, C-Clamps; pedal tray, braking system, and safety gear for the car and drivers
- In-house assembly of Kart and testing [\[Link\]](#)

## Summer Research Intern

Indian Institute of Technology

Ropar, IN

Jun. 2021 – Jul. 2021

- **Faculty Coordinator: Prof. Neeraj Goel**
- AI - CPS for Agriculture Automation
- Developed mobile based application for indigenous plant disease classification and develop CPS framework to automate the same.
- **Tech Stack** : Python [Tensorflow/ TFLite] | Flutter [Dart] [\[Link\]](#) [\[More info\]](#)

## Science Residency Program

Indian Institute of Technology

Chennai, IN

May. 2018 – Jun. 2018

- Device and characterization of environmental friendly material in Exploit.
- Metal-Organic Frameworks as advanced moisture sorbents for energy-efficient high temperature cooling
- Design and Fabrication of Sustainable Air cooler
- **Tech Stack** : Solidworks and COMSOL Multi-physics [\[More info\]](#)

## Grants and Awards

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### Vector Scholarship in Artificial Intelligence

Vector Institute for AI

[\[More info\]](#)

2023 - 2024

- Scholarship for M.A.Sc. research, valued at 17,500 CAD

### Globalink Research Intern

MITACS & All India Council for Technical Education

[\[More info\]](#)

2022

- Multi-modal and multi-sensory representation learning for robotics.
- Awarded a sum of **12,000 CAD** towards MITACS GRI internship [\[Link\]](#)
- Entitled to Global Graduate Fellowship worth **15,000 CAD** to pursue my graduate studies in Canada

### Title Winner | India Academia Connect AI Hackathon

NVIDIA

[\[Slides\]](#)

2021

- Realtime Pose, action recognition; Joint Detection and Embedding for fast multi-object tracking (Rendered @30 FPS)
- Won the coveted cash prize of **2 Lakhs INR** [\[Link\]](#)
- Over 500 teams from All over India

### Tamil Nadu Student Innovator | Winner

Entrepreneurship Development Institute of India

Chennai, IN

2020

- Won a seed grant of **1 lakh INR** [\[Link\]](#)
- Designed and Fabrication of in-house Low cost ventilation system - Metal Organic Framework (amphiphilic) for high temperature cooling
- Pilot-project of the same undergoing in Thangalancheri - Madurai, IN

### Rural Development Fund

Ministry of Agriculture

Chennai, IN

2020

- Proposed Project under MRTI - Rural Development Fund - 4.6 lacs INR [\[Link\]](#)
- Innowah Finalist students were given a grant of 10,000 INR and provided support for incubation at IITM - Research Park

### NCVPRIPG-2023

3D Reconstruction and Restoration of Indian Heritage from Partial and Noisy Scans

[\[Link\]](#)

2023

- Fast and Robust 3D point-cloud registration [\[Link\]](#)
- Awarded a sum **10K INR**

### COVID 19 Research Grant

Google Cloud Platform

[\[Data\]](#)

2020

- Awarded a sum of 1600 USD [\[Link\]](#)
- Automated annotation and classification of Catheters, Heatmap generation of catheter endpoints for verification of insertions and placement via Chest X-Rays.
- This helps automating the labour intensive task of post-verification of catheter insertions by radiologist. This can also be extended to a instance segmentation task on CXR's or Ultrasound images to help autonomous catheter insertions.

## Lyft - Level 5

[Github]

Build motion prediction models for self-driving vehicles

2020

- Awarded 300 USD for training and prototyping of NN models for motion forecasting in vehicles
- Also building of rasterizer to enable quickly process BEV images to process agent dynamics and forecast using convnets. [Link]
- Development of Vectornet architecture (vectorized agent dynamics and mapping) to forecast the motion (based on realtime datasets from Lyft) [Link] [Model]

## Research Projects

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### Instant Depth Aware Reconstruction and Grasp Planning for Transparent Objects

[Prototyping]

Vision System Lab

2023

- Instant Neural Radiance Field based implicit rendering for geometry estimation from casual videos
- Estimation of Geometry (Mesh Recovery), pose-estimation and Grasp Planning for transparent objects can be achieved
- Automate single station workcell for in-situ testing (clean room) and bio-medical applications.

### Google Landmark Recognition Challenge

[Code]

Google

2021

- Used DELF and DOLG based approaches to find and extract features
- Use of Additive Angular Margin Loss (ArcFace), and other Bag-of-tricks from person re-identification
- Random Erasing, label smooth, triplet loss, IBN-extension.
- Hosted as a part of ICCV 2021 [kaggle]
- Placed 58/392 participants

### Google Smartphone Decimeter Challenge

[Link]

Google

2021

- Improve high precision GNSS positioning and navigation accuracy on smartphones [Model]
- Process and clean the GNSS logs to compute location down to decimeter or even centimeter resolution placed 94/810
- Making 2D image input with Short Time Fourier Transform, STFT, and then using ImageNet convolutional neural network
- Use of Kalman smoothing and constant velocity heading model to improve accuracy of GNSS data, more visualization in repo

### ROS - Wrapper for Autonomous Landing

AirSim

2020

- Involved in detection and tracking of helipad (Pose-estimation task based)
- Use of mpc-controller for giving setpoints to the firefly
- Ported the same environment to PX4 and AirSim with the help of ROS wrappers and thus extending the tasks to online segmentation, surveying and Simultaneous Localization and Mapping
- The above can still be extended to various application of field robotics and swarm based applications to execute surveying and for VIO and loop closure detections

### Segment and label helmets in video footage

[Video]

The National Football League

2022

- Detector to find helmets, Image2Map (BEV)
- Classifier to classify players into 2(H/V) teams and Registration of detected players on 2D map to provided tracking data. Later track detected bounding boxes and reassign players.
- Matching predicted players on 2D map to the provided tracking data. ICP (Iterative Closest Points) based algorithm. Iteratively solve the nearest search and normal equation to get 4 unknown parameters (xy translation, rotation and zoom ratio) by least squares fitting.
- Predict the 2022 College Men's Basketball Tournament

### Bag-Valve Mask ventilator

[Slides]

Capstone Design Project - Automatic pressure controlled Ventilator

2022

- Design and prototype a slider-crank based actuation mechanism to automate the compression in BVM ventilator.
- Performed Pressure trajectory analysis to achieve required PIP and PEEP values at outlet with the help of COMSOL multiphysics module
- Currently working on Control module adapted from [here](#)

### G2Net Gravitational Wave Detection

European Gravitational Observatory - EGO

2021

- Find gravitational wave signals from binary black hole collisions
- FFT pre-processing and 1D-CNN model
- Placed 33/1219 participants

### Optical Characterises of Low power solar cell for space application

[XRD]

Interdisciplinary Nano Research Centre - SVCE

2020

- DC/ RF sputtering for fabrication of **ZnO thin-film** semi-conductor devices with custom mask.
- Investigation or study or analysis of Structural and optical characteristics of **sputtered MoS<sub>2</sub> thin film** with annealing for PV applications or for flexible opto-electronic devices

### **Nanophotonic-Enabled Solar Membrane Distillation**

Systems Engineering Project - Off-grid Purification

2021

- Design and Fabrication of Membrane bound distillation
- XRD and RAMAN analysis of thus fabricated membrane and to perform characterization of the same.
- The same membrane bound approach was further tried out with a help of cross-flow shell type heat-exchanger to improve efficiency with the help of COMSOL

### **Indian National Space Settlement Design Competition**

[\[Link\]](#)

ARSSDC & NASA

2018

- Design and build the first space settlement to establish large-scale industrial operations in cis-lunar space
- Acted as team lead and successfully submitted proposal for a complete design comprising of sub-system level innovations ranging from thrusters to initial habitat establishment at Moon's largest crater.