

# Akash Karthikeyan

Student Researcher

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## Education

### Thiagarajar College of Engineering

Bachelor of Mechanical Engineering

GPA : 9.33/10.00 Top 1 % percentile

**Featured Coursework:** Robotics, Finite Element Analysis, Machine Vision, Kinematics and Dynamics of Machinery

Madurai, IN

Jun. 2021 - Jun. 2023

### Lalaji Memorial Omega International School

Higher Secondary

AISSE - 92.4 % AISSCE - 10 GPA

Class Valedictorian Top 1 % percentile

Chennai, IN

2017 - 2019

## Research Interest

My research interest lies at the intersection of **robotics and computer vision**, to build robotic systems capable of safe and efficient interactions with humans and the environment. I'm currently exploring **NeRF**'s application for recovering deformable objects from casual videos.

**Bottleneck: No Prior nor use of template based methods (i.e., SMPL ..)**

Few other stuff I worked on **Motion Forecasting - Simultaneous Localization and Mapping**

## Technical Skills

### Programming

Python, Robotic Operating System, MATLAB, Pytorch & TensorFlow, C

### Design and Analysis Softwares

SolidWorks, CREO, Ansys Fluent, Ansys Workbench, COMSOL Multiphysics, HyperWorks

### Animation & Typesetting

Unreal Engine, Blender, L<sup>A</sup>T<sub>E</sub>X

### Miscellaneous

GCP, Docker, Singularity, SLURM

### Languages

Tamil (Native), English, Hindi

## Publications

- [1] **Akash K\***, Saravana Perumaal Subramanian. "Automated Annotation and Classification of Catheters in Chest X-Rays" *International Conference on Computer, Communication, and Signal Processing*, 2022 [\[Link\]](#)
- [2] **Akash K\***, Sheik Abdullah. "A New Model of Zero Energy Air Cooler: An Cost and Energy Efficient Device in Exploit." *Recent Advances in Power Electronics and Drives*, vol 707. Springer, Singapore. [\[Link\]](#)

## Work Experience

### Research Scholar

Intelligent Systems Lab, University of Toronto

Toronto, CA

Feb. 2022 - Present

- **Guide: Prof. Igor Gilitschenski**
- Skeleton-based Animatable and Class-agnostic meshes from casual monocular videos without any priors or camera poses
- Introduced DINO features based class agnostic features to improve long range correspondences and thereby optimize camera poses
- 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 [\[Link\]](#)

### 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 Volume, Mass data from such obtained meshes
- 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**
- 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] [\[Link\]](#) [\[More info\]](#)

## Indian Institute of Technology

Science Residency Program

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 [\[More info\]](#)

## Research Grants

### Globalink Research Intern

[\[More info\]](#)

MITACS & All India Council for Technical Education

2022

- Multi-modal and multi-sensory representation learning for robotics.
- Granted a sum of 12k CAD for the perusal of MITACS internship [\[Link\]](#)

### Title Winner | India Academia Connect AI Hackathon

[\[Slides\]](#)

NVIDIA

2021

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

### Tamil Nadu Student Innovator challenge

Chennai, IN

Entrepreneurship Development Institute of India

2020

- Won a seed grant of 1 lakh INR [\[Link\]](#)
- Designed and Fabrication of in-house Low cost ventilation system
- Pilot-project

### Rural Development Fund

Chennai, IN

Ministry of Agriculture

2020

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

### COVID 19 Research Grant

[\[Data\]](#)

Google Cloud Platform

2020

- Awarded a sum of 1600 USD [\[Link\]](#)
- Automated annotation and classification of Catheters, Heatmap generation of catheter endpoints

### 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 [\[Link\]](#)
- Use of Vectornet architecture to forecast the motion prediction [\[Link\]](#) [\[Model\]](#)

### AICTE Vishwakarma awards

Madurai, IN

Thiagarajar College of Engineering

2019

## Research Projects

### Google Landmark Recognition Challenge

[\[Code\]](#)

Google

2021

- Use of Additive Angular Margin Loss (ArcFace), and other Bag-of-tricks from person re-identification
- Random Erasing, label smooth, triplet loss, IBN-extension, last stride=1.
- 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
- Use of Kalman smoothing and constant velocity heading model to improve accuracy of GNSS data, more visualization in repo

### Segment and label helmets in video footage

[\[Link\]](#) [\[Video\]](#)

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.
- Predict the 2022 College Men's Basketball Tournament
- Analyse the trend based on past 5 year's data

### TensorFlow - Help Protect the Great Barrier Reef

[\[Link\]](#)

TensorFlow

2022

- Use of Optical flow to track the detected objects in a video sequence to improve confidence
- Use of Weighted box fusion and augmentation techniques to get better scores

### Happywhale - Whale and Dolphin Identification

[\[Link\]](#)

Happywhale

2022

- Placed 44/1588 participants
- Identify whales and dolphins by unique characteristics
- Used DELF and DOLG based approaches to find and extract features

### G2Net Gravitational Wave Detection

European Gravitational Observatory - EGO

2021

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

### 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

### Under Actuated robotic hand

[\[Video\]](#)

TCE - Mechanical Engineering

2020

- Modeling and fabrication of a new 3D printable robotic hand for the humanoid robot
- 7 DOF and cost economic solution

### Nanophotonic-Enabled Solar Membrane Distillation

[\[Video\]](#)

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 efficieny

### 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 succesfully submitted proposal for a complete design comprising of sub-system level innovations ranging from thrusters to initial habitat establishment at Moon's largest crater.

### Bag-Valve Mask ventilator

[\[Slides\]](#) [\[Assembly\]](#)

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

### MMDet Toolkit

[\[Link\]](#)

Sartorius - Cell Instance Segmentation

2022

- Detect single neuronal cells in microscopy images.

## Awards and Honors

May.-Sep. 2022	<b>Fellowship:</b> "MITACS GRI "	<i>Toronto</i>
Nov. 2021	<b>Contest:</b> First Place in "India Academia Connect AI Hackathon"	<i>India</i>
Nov. 2020	<b>Contest:</b> Finalist in "Innowah IIT Madras"	<i>Chennai</i>
Jun. 2018	<b>Honorary Title:</b> "Young Environmental Scientist"	<i>Chennai</i>
2017, 2018	<b>Honorary Title:</b> "Student of the Year"	<i>Chennai</i>

## Position of Responsibilities

## MITACS Global Research Fellow

Globalink Research Fellow

2022 - Present

- Alumnus of MITACS GRI program help incoming interns to have a better onboarding experience and help guide them towards smooth start of their projects and collaborations

## Yukta Racing

Madurai, IN

Steering Sub-system Lead

Jul. 2020 - Present

- Design, engineer, build and test Go-Kart (F9 Racing Team) [\[Link\]](#)
- Responsible for Designing and building control, brakes and safety
- Reach out to potential sponsors and investors and oversee the manufacturing activities

## TCE- TBI

Madurai, IN

Mentorship and Teaching

2020 - 2023

- Mentoring of various potential interdisciplinary projects, helping students to build proof of concept, later develop market ready products.
- Institute Student Mentorship Programme (mentored 12 freshmen)
- **18ES390 – DESIGN THINKING** : Department Academic Mentorship Programme (mentored 6 sophomores)

## National Cadet Corps

Chennai, IN

Pilot Sergeant

2015 - 2017

- Best outgoing cadet 2017
- Participated and won in cross-country marathons in CATC/RDC camps.

## References

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### MITACS - Globalink

Toronto, CA

#### Director - Intelligenet Systems Lab

Feb. 2022 - Present

- **Prof. Igor Gilitschenski**  
Ph. D, Assistant Professor, Department of Computer Science, University of Toronto,  
✉ [igor@gilitschenski.org](mailto:igor@gilitschenski.org)

### Thiagarajar Business Incubator

Madurai, IN

#### Director - Thiagarajar College of Engineering

Feb. 2019 - Present

- **Prof. V.Abhaikumar**  
Ph. D, Professor, Department of Electronics and Communication Engineering, Thiagarajar College of Engineering,  
✉ [tbi@tce.edu](mailto:tbi@tce.edu)

### Department of Mechanical Engineering

Madurai, IN

#### Head of Department

Jul. 2019 - Present

- **Prof. A. Valan Arasu**  
Ph. D, Professor, Thiagarajar College of Engineering,  
✉ [avamech@tce.edu](mailto:avamech@tce.edu)

### Vision Systems Lab

Madurai, IN

#### Director

Dec. 2019 - Present

- **Prof. S. Saravana Perumal**  
Ph. D, Assistant Professor, Department of Mechanical Engineering, Thiagarajar College of Engineering,  
✉ [sspmech@tce.edu](mailto:sspmech@tce.edu)