Akash Karthikeyan

Student Researcher

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Education

Thiagarajar College of Engineering *Madurai, IN*
Bachelor of Mechanical Engineering *Jun. 2019 - May. 2023*
CGPA : 9.33/10.00

Lalaji Memorial Omega International School *Chennai, IN*
Higher Secondary *2017 - 2019*
All India Secondary School Examination - 92.4%   **All India Secondary School Examination -** 10 **GPA**

Research Interest

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

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, Gazebo,LaTeX
Miscellaneous	GCP, Docker, Singularity, SLURM
Languages	Tamil (Native), English, Hindi

Publications

[1] Tianshu Kuai, **Akash Karthikeyan**, Yash Kant, Ashkan Mirzaei, Igor Gilitschenski "CAMM: Building Category-agnostic and Animatable 3D Models from Monocular Videos" *Under Review*, 2022

[2] **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

Summer Research Intern *Toronto, CA*
Intelligent Systems Lab, University of Toronto *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 *Madurai, IN*
Vision Systems Lab, TCE *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 *Madurai, IN*
Lead Steering Sub-system *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 [Report] [Link]

Summer Research Intern   *Ropar, IN*

Indian Institute of Technology   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   *Chennai, IN*

Indian Institute of Technology   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.
- Awarded a sum of **12,000 CAD** towards MITACS GRI internship [Link]
- Entitled for Global Graduate Fellowship worth **15,000 CAD** to pursue my graduate studies in Canada

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 | Winner   *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 - Metal Organic Framework (amphiphilic) for high temperature cooling
- Pilot-project of the same undergoing in Thangalancheri - Madurai, IN

Rural Development Fund   *Chennai, IN*

Ministry of Agriculture   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

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 endtips for verification of insertions and placement via Chest X-Rays.

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]
- Development of Vectornet architecture (vectorized agent dynamics and mapping) to forecast the motion (based on realtime datasets from Lyft) [Link] [Model]

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 smoothening 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 approches to find and extract features

G2Net Gravitational Wave Detection

European Gravitational Observatory - EGO   2021

- Find gravitational wave signals from binary black hole collisions
- FFT pre-processsing 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_2 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 *[Slides]*

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	**Fellowship**: "MITACS GRI "	*Toronto*
Nov. 2021	**Contest**: First Place in "India Academia Connect AI Hackathon"	*India*
Nov. 2020	**Contest**: Finalist in "Innowah IIT Madras"	*Chennai*
Aug. 2020	**Honorary Title**: "Tamil Nadu Student Innovator"	*Chennai*
Jun. 2018	**Honorary Title**: "Young Environmental Scientist"	*Chennai*
2017, 2018	**Honorary Title**: "Student of the Year"	*Chennai*

Position of Responsibilities

MITACS Global Research Fellow

Globalink Reseach 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 Sergent   2015 - 2017

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

References

MITACS - Globalink   *Toronto, CA*

Toronto Intellignet Systems Lab

- **Prof. Igor Gilitschenski**
  Ph. D, Assistant Professor, Department of Computer Science, University of Toronto,
  ✉ igor@gilitschenski.org

Thiagarajar Business Incubator   *Madurai, IN*

Director - Thiagarajar College of Engineering

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

Department of Mechanical Engineering   *Madurai, IN*

Head of Department

- **Prof. A. Valan Arasu**
  Ph. D, Professor, Thiagarajar College of Engineering,
  ✉ avamech@tce.edu

Vision Systems Lab   *Madurai, IN*

Principal Investigator

- **Prof. S. Saravana Perumal**
  Ph. D, Assistant Professor, Department of Mechanical Engineering, Thiagarajar College of Engineering,
  ✉ sspmech@tce.edu