Engineering 7
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Akash Karthikeyan

Research Interest. Reinforcement Learning, Generative Modeling, Neural Radiance Fields (3DV), Task Action Motion Planning, Robotics Perception

Education

2023–2025 **Master of Applied Science (MASc)**, *in Electrical and Computer Engineering*, Pattern Analysis and Machine Intelligence.
University of Waterloo, Canada — GPA 3.7/ 4.0
Advisor: Prof. Yash Vardhan Pant

2019–2023 **Bachelor of Engineering (B.E.)**, *in Mechanical Engineering*.
Thiagarajar College of Engineering (affiliated to Anna University), India — GPA 9.16/ 10
Thesis Title: Instant Depth Aware Reconstruction and Grasp Planning for Transparent Objects
Advisor: Prof. S. Saravana Perumaal

Awards and Honors

Vector Scholarship in Artificial Intelligence	Ontario	Sep. 2023
MITACS Gobalink Graduate Fellowship	Ontario	Sep. 2023
Best Outgoing Student - BE Mechanical Engg. (Department - Gold)	Madurai	Feb. 2023
Runner up | NCVPRIPG 3D Reconstruction and Restoration	Jodhpur	Feb. 2023
MITACS Globalink Research Fellowship	Toronto	May 2022
Winner | India Academia Connect AI Hackathon	India	Nov. 2021
Kaggle Competitions Expert - Ranked 232 globally!	India	Nov. 2021
Runner Up | March Machine Learning Mania	Global	Apr. 2022
Winner | Tamil Nadu Student Innovator	Chennai	Aug. 2020
Covid 19 Research Grant | GCP	Google	Mar. 2020
Lyft - Level 5 | GCP Grant	Kaggle	Feb. 2020
Young Environmental Scientist	Chennai	Jun. 2018

Publications

Preprint 2024 **[Pre2] GenPlan: Generative sequence models as adaptive planners**, *Under Review*.
Akash Karthikeyan, Yash Vardhan Pant

Preprint 2024 **[Pre1] Adaptformer: Sequence models as adaptive iterative planners**, *Under Review*.
Akash Karthikeyan, Yash Vardhan Pant

AIA 2024 **[C1] Adaptformer: Sequence models as adaptive iterative planners**, *AAAI 2024 Spring Symposium on User-Aligned Assessment of Adaptive AI Systems*, Stanford University, CA, USA (Spotlight Talk).

WACV 2024 **[P1] AvatarOne: Monocular 3D Human Animation**.
Akash Karthikeyan, Robert Ren, Yash Kant, Igor Gilitschenski (Poster Talk).

CVPRW 2023 **[P2] CAMM: Building Category-Agnostic and Animatable 3D Models from Monocular Videos**.
Tianshu Kuai, **Akash Karthikeyan**, Yash Kant, Ashkan Mirzaei, Igor Gilitschenski

ICCCSP 2022 **[C2] Automated Annotation and Classification of Catheters in Chest X-Rays**.
Akash Karthikeyan, Saravana Perumaal Subramanian

Experience

2023– **Graduate Researcher**, *Control Learing and Logic Group*, University of Waterloo.
Builing learning based Decision Making and Task planning frameworks. [C1], [Pre1]
Reinforcement Learning/ Diffusion / LLMs/ Energy Based Models/ Intrinsic Rewards

2022–2023 **Visiting Researcher**, *Intelligent Systems Lab*, University of Toronto.
Built end-2-end fast human avatar rendering only from monocular video. [P1]
Built template-free method for animatable 3D models of various deformable objects. [P2]
Neural Radiance fields/ SMPL/ SfM/ COLMAP

2020–2023 **Student Researcher**, *Vision Systems Lab, TCE*, Madurai, IN.
Estimated 3D shapes using multi-view RGB images; and camera extrinsic via learned correspondences
Reconstructed objects in CAD for future redesigns based on scans.
Reconstruct the same in CAD and allow future redesigning from scans
Implemented SLAM and RRT for autonomous navigation in GPS-denied environments.
ROS / SLAM/ Motion Forecasting

2020–2022 **Steering Subsystem Lead**, *Yukta Racing, TCE*, Madurai, IN.
Numerical G-G diagram for design parameter exploration and to better understand vehicle dynamics
Design and Manufacture with high degree of precision for the following components: steering wheel, steering column tie rod, C-Clamps; pedal tray, and braking system.
SolidWorks / CFD/ CAM

Jun–Jul 2021 **Summer Research Intern**, *Indian Institute of Technology*, Ropar, IN.
AI - CPS for Agriculture Automation More info
Developed mobile based application for indigenous plant disease classification and develop CPS framework to automate the same.
Flutter / TFlite/ ESP32

Sep–Feb 2019–2020 **Science Residency Program**, *Indian Institute of Technology*, Chennai, IN, (Talk).
Device and characterization of environmental friendly material in Exploit. Finalist Award
Metal-Organic Frameworks as advanced moisture sorbents for energy-efficient high temperature cooling
Design and Fabrication of Sustainable Air cooler.
SolidWorks / COMSOL Multiphysics/ CFD/ TGA

Research Projects

Vision System Lab **Instant Depth Aware Reconstruction and Grasp Planning for Transparent Objects (Link)**.
- 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.

Google Bronze Medal **Google Landmark Recognition Challenge (Link)**.
- Build DELF and DOLG based approches to find and extract features.
- Adopted Additive Angular Margin Loss (ArcFace), and other Bag-of-tricks from person re-identification.
- Hosted as a part of ICCV 2021, Placed 58/392 participants

Google Bronze Medal **Google Smartphone Decimeter Challenge (Link)**.
- Improve high precision GNSS positioning and navigation accuracy on smartphones. (Presentation)
- Process and clean the GNSS logs to compute location down to decimeter or even centimeter resolution, Placed 94/810
- Implemented Short Time Fourier Transform (STFT), to model time-series as image data, thus using ConvNet Models to perfrom state estimation.

Vision System Lab **AirSim: ROS - Wrapper for Autonomous Landing**.
- Involved in detection and tracking of helipad (pose-estimation task).
- Used MPC-controller for providing setpoints to the firefly.
- Ported the environment to PX4 and AirSim with the help of ROS wrappers, extending tasks to online segmentation, surveying, and Simultaneous Localization and Mapping.
- Extended applications to field robotics and swarm-based applications for surveying, Visual-Inertial Odometry (VIO), and loop closure detections.

The National Football League **Segment and Label Helmets in Video Footage (Video)**.
- Developed a detector to find helmets and Image2Map (BEV).
- Created a classifier to classify players into home and visiting teams and register detected players on a 2D map with provided tracking data.
- Tracked detected bounding boxes and reassigned players, matching predicted players on a 2D map to the provided tracking data using an Iterative Closest Points (ICP) algorithm.
- Collision detections and tracking tasks.

Capstone Design Project
Automatic Pressure Controlled Ventilator (Slides).
- Designed and prototyped a slider-crank-based actuation mechanism to automate the compression in a BVM ventilator.
- Performed pressure trajectory analysis to achieve required PIP and PEEP values at the outlet with the help of the COMSOL multiphysics module.
- Built on top of control module adapted from here.

European Gravitational Observatory
EGO: G2Net Gravitational Wave Detection.
- Detected gravitational wave signals from binary black hole collisions.
- Applied FFT preprocessing and developed a 1D-CNN model.
- Placed 33rd out of 1219 participants.

Nano Research Centre - SVCE
Optical Characteristics of Low Power Solar Cell for Space Application (XRD).
- Performed DC/RF sputtering for the fabrication of **ZnO thin-film** semiconductor devices with a custom mask.
- Investigated structural and optical characteristics of **sputtered MoS_2 thin film** with annealing for PV applications or flexible optoelectronic devices.

Volunteer Activities

TCE- TBI — President | Institute Student Mentorship Programme (mentored 12 freshmen)

18ES390 — Design Thinking: Department Academic Mentorship Programme

Reviewer — IROS 2024, CCTA 2024