Aditya KAMIREDDYPALLI

PhD Candidate| RAD Group, IPAB Informatics, University of Edinburgh

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⌗ github.com/Kzernobog ⚲ Edinburgh, UK

Robotics Researcher. I am interested in Robot learning, specifically contact reasoning within the context of contact-rich manipulation. The central question I'd like to investigate is can we use Hybrid state estimation and Learning with force feedback to equip robots to interact and perceive the world around them, with specific application to contact-rich insertion.

💼 EXPERIENCE

Present
January 2022

PhD candidate | RAD Group, IPAB, UNIVERSITY OF EDINBURGH, Edinburgh UK
⌗ RAD
> Research Interests : Robot Learning for contact rich manipulation.
> Deepmind Young Researcher Awardee - ICRA 2023

December 2021
January 2021

Masters by Research | RAD Group, IPAB, UNIVERSITY OF EDINBURGH, Edinburgh, UK
⌗ RAD
> Thesis : Parameter Estimation of deformable materials using Non-prehensile robotic primitives (indentation), Saifer-Surgery project - ongoing
> ⌗ Real Robot Challenge , hosted by Max Planck Institute for Intelligent Systems, Emperical Inference - secured 4th position in stage 1 and 3rd position in stage 2 - completed
> First Class Honors.
ROS   ROS2   TriFinger Robot   UR10

September 2020
February 2019

Research Assistant | RRC, ROBOTICS RESEARCH CENTRE, IIIT-H, Hyderabad, India
⌗ RRC
> Small Obstacle Discovery project
> GCRF and Mergenet papers implemented
> Small Obstacle Dataset release
ROS   Camera-Lidar Calibration   Lidar Range Image construction   PyTorch

January 2019
March 2018

Team Lead | Algorithms and Systems Architect, ZEN TECHNOLOGIES LIMITED, Hyderabad, India
⌗ Zen Technologies
> Prototyped Perception and Robotics Module for the Generic Object Tracking System.
NVIDIA Jetson TX2   CUDA   PID Motor Control

March 2018
October 2017

AI Research Engineer | Algorithms, ZEN TECHNOLOGIES LIMITED, Hyderabad, India
⌗ Zen Technologies
> Benchmarked Object Detection and Object Tracking frameworks
> Data Pipeline for Simulator - Project in collaboration with Paladin AI

September 2017
August 2016

Embedded Software Engineer, ZEN TECHNOLOGIES LIMITED, Hyderabad, India
⌗ Zen Technologies Ltd
> Acoustic Event Triangulation
> Indoor Tracking System
> Motion Platform for the Air-Surface Missile simulator
C++   Unreal   Unity   C#

July 2013	Data Analyst, Braintree, Hyderabad , India
July 2016	› Database management
	› sequel

🎓 Academics

2020-2021	MSc by Research (MScR) graduated with Merit : Robotics, University of Edinburgh ; Supervised by Professor Subramanian Ramamoorthy
2009-2013	Bachelors in Engineering (B.E) (Honors) Civil Engineering, BITS Pilani, Pilani Campus
2009	Secured rank 2399 out of almost 500,000 students who appeared for the IIT-JEE engineering entrance test.
2009	Secured rank 437 out of almost 200,000 students who appeared for the BITSAT engineering entrance test.

📖 Publications and Scholarships

2020	Singh, Aasheesh* **Kamireddypalli, Aditya*** Gandhi, Vineet Krishna, Madhav "LiDAR Guided Small Obstacle Segmentation." 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, 2020. 8513–8520. Web.
2021	☑ OpenReview Grasp and Motion Planning - Real Robot Challenge 2021
2021	University of Edinburgh, IPAB scholarship for MSc by Research

💻 Projects

Real Robot Challenge | Team : dopeytacos   Robust Autonomy Decisions Group, University of Edinburgh

☑ Real Robot Challenge   ☑ Code   ☑ RAD

Solved engineering tasks of setting up control loops in simulation and the real TriFinger robot. Implemented the pose estimation module for the stage 2 task of dice rearrangement

> Achieved 4th position on leaderboard for Stage 1 on real the robot.
> Achieved 3rd position on leaderboard for Stage 2 on the real robot
> **Skills** : ROS2, ROS, Motion Planning and Control.
> **Robots** : TriFinger robot

Research Project

Parameter Estimation of Deformable Materials | Thesis   Robust Autonomy Decisions Group, University of Edinburgh

☑ RAD

Estimate physical parameters of deformable materials such using nonprehensile motion primitives, like indentation poking etc.

> Used Robotic indentation primitives to estimate the Young's Modulus and Shear Modulus of the *Ecoflex* material.
> Utilised Finite Element Method to simulate a Neo-Hookean Material model of the deformable object.
> Optimised material parameters using the LBFGS optimisation scheme.
> Utilised inverse-FEM
> **Skills** : Numerical Optimization (LBFGS++, Levenberg-Marquardt), AprilTag markers, ROS-MoveIt.
> **Robots** : UR10s, Panda

Thesis Submitted

Small Obstacle Discovery on Road Scenarios | Research Assistant   RRC, IIIT-H

🔗 Project Site   🔗 ArXiv

My work in RRC lied within the broader field of perception for autonomous vehicles. Our team's work on Lidar guided Small Obstacle Segmentation was accepted into IROS 2020 as part of the conference proceedings

- › The project aims to detect drivable road spaces, particularly in India road scenarios, using Lidar and RGB camera
- › Posing the problem as a computer vision semantic segmentation problem, we experimented with various sensor modalities - primarily Lidar and RGB Camera.
- › Following threads of research were explored
  - › Application of Uncertainty in Deep Learning to Computer Vision
  - › Confidence propagation in a dual CNN framework
  - › Sparse knowledge representation(particularly for Lidar) - Range Image representation of Lidar or the Image projections
  - › Semi-Supervised/Self-Supervised training for Semantic Segmentation(GCRF Loss)
- › GCRF loss paper implemented. GCRF loss tries to decrease the amount of supervision required for semantic segmentation tasks. 🔗 colab
- › Worked with Camera-Lidar calibration. Developed a Hausdorff distance based incremental technique for fine tuning the Lidar-Camera Calibration - we are working on summarising our work as an article.
- › The Small Obstacle Discovery Dataset. This data aims to streamline research within the broader small obstacle discovery track. Will be released along with the paper submission. Examples can be found on the project website.
- › **Skills** : Deep Learning Training Loops, PyTorch, Computer Vision, ROS, research skills

Research Project

Generic Object Tracking System | Team Lead   Zen Technologies Limited

Led a multidisciplinary team to prototype and test a Perception Module and Robotics Module for a turret based Object Tracking System. The turret orients itself to track targets based on control from the perception module.

- › Perception Module
  - › Software Architect and Lead Programmer.
  - › Developed the Computer Vision Module that detected and tracked user given objects of interest.
  - › Employed Deep Learning Computer Vision techniques, primarily Convolutional Neural Nets, for object detection.
  - › Deployed a Deep Learning based and traditional vision based trackers.
  - › Engineered the model to be deployed it on the Nvidia Jetson TX2.
  - › **Skills** : Embedded Programming (cuda, Embedded C, C++)
- › Robotics Module
  - › Interfaced motor control and the micro-controller to the Computer Vision Module. This was done via a combination of serial media and Socket communication(TCP/IP protocol) using Remote Procedure Call architecture.
  - › Assisted in prototyping the basic PID motor control logic in Python.
  - › **Skills** : ROS

Robotics Systems Project

Object Tracking and Detection | AI Research Engineer   Zen Technologies Limited

Bench-marked and profiled object detection and object tracking algorithms.

- › Object Detection
  - › YOLO, R-CNN, Faster R-CNN
- › Object Tracking
  - › Kalman Filter based tracking, Dlib tracker, ROLO, Track2Detect.
- › Trained a person detector and installed it in Zen's Tactical Simulator.

Research Project

Data Pipeline for Weapon's simulator | AI Research Engineer
ZEN TECHNOLOGIES LIMITED

⬀ Product Site

Collect relevant data from simulator for future modelling. This project was in collaboration with ⬀ Paladin AI .

> Programmed a C++ application to communicate sensor data from an accelerometer module, via serial media communication.
> These accelerometer modules were used to collect recoil data from simulated weapons.
> Programmed a .NET C# patch for the existing weapon's simulator, this module collected and automatically labeled the accelerometer data.
> This data is used to model trainee abilities and develop training curriculum.
> Deployed in many Army training sites across India, generates accelerometer data. This data is used for the Adaptive Learning module of the simulator.

Production Project

Acoustic Event Triangulation | Software Engineer
ZEN TECHNOLOGIES LIMITED

⬀ Product Site

The aim of the project was to triangulate the position of an acoustic event on a test 2x2 sq. meter resealable rubber frame. Optimises Time-difference-on-arrival data from acoustic sensors for 2d coordinates of the point of entry.

> Programmed a software library implementing the Levenberg-Marquardt optimisation algorithm in C and C++ with common API.

Production Project

Infrared Event Triangulation | Software Engineer
ZEN TECHNOLOGIES LIMITED

⬀ Product Site

Used Image Processing to try and detect Infrared event location on a test 2x2 sq. meter resealable rubber frame. The infrared event takes the form of a ballistic piercing through the rubber.

> Using an IR camera filter, tried to detect IR signatures on the frame using traditional blob detection algorithms.

Research Project

Indoor Tracking System | Software Engineer
ZEN TECHNOLOGIES LIMITED

⬀ Product Site

This project is an elaborate sensor setup to simulate tactical homeland security exercise scenarios. The tracking system triangulates the location of a trainee in real time.

> Programmed an application in C++ that calibrated the internal Radio Frequency sensors.
> Programmed a UI application in C++ that showed the position of trainee within the simulated environment.

Production Project

Hardware Interface with Surface-Air Ballistic system Simulator | Software Engineer
ZEN TECHNOLOGIES LIMITED

⬀ Product Site

The simulator system is a game interface that the user interacted with while training to fire a short range Surface-to-Air missile.

> Programmed a C++ Driver to communicate with the hardware of a simulator.
> Used UDP Socket communication to relay hardware sensor data - Accelerometer, gyroscope - to the main Unreal based simulator application. Utilised the Remote Procedure Call architecture.

Production Project

Simulated Game Room | Software Engineer
ZEN TECHNOLOGIES LIMITED

Programmed a C# application using the Microsoft Kinect to calculate the percentage body exposure of a trainee. This information was used to virtualise teams in different rooms in a game like scenario.

Research Project

☰ Skills

Programming	C Family (C++(Proficient), C#(Proficient)), Python(Advanced)), Microsoft .NET, CUDA (Beginner)
DL Frameworks	PyTorch (Experienced), TensorFlow/Keras (Experienced)
Robotics	ROS, Lidar Range image construction, Camera-Lidar Calibration (Zhang's Method), Socket Communication (TCP/IP), Serial Media Communication
Robots	Dual UR10 (RAD University of Edinburgh), Trifinger Robot (Empirical Inference, Max Planck Institute), Panda
Miscellaneous	SVN, git, Unreal, Unity, Realty

🎓 Relevant Moocs

2017	Machine Learning ↗ link
2017	Neural Networks and Deep Learning ↗ link
2017	Improving Deep Neural Networks : Hyperparameter tuning, Regularization and Optimization ↗ link
2017	Convolutional Neural Networks ↗ link
2017	Structuring Machine Learning Projects ↗ link
2018	CS50 edX - audit
2019	Nand to Tetris Coursera - audit
2019	Algorithmic Design and Techniques edX - audit

❝ References

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Dr. Yordan Hristov
Postdoctoral Researcher, Facebook AI Research
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