Gokul Raju Govinda Raju

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Education

ETH Zurich *Sep 2022 – Jul 2025*
MSc in Robotics, Systems and Control

- **Coursework:** Introduction to Machine Learning, Probabilistic Artificial Intelligence, Image Analysis & Computer Vision, 3D Vision, Planning & Decision Making for Autonomous Robots, Robot Dynamics, Dynamic Programming & Optimal Control, Autonomous Mobile Robots
- **Master Thesis:** State-Space Models for Efficient Reinforcement Learning in Quadrotors
- **Semester Thesis:** Pushing the Limits of Optical Flow Estimation for Event Cameras

Heriot-Watt University, Dubai *Sep 2018 – Jul 2021*
BEng in Mechanical Engineering (Hons.)

- **Bachelor Thesis:** Fault Diagnosis of Rolling Element Bearings using Artificial Neural Networks
- **Watt Club Medal (2021):** Awarded to the student and achieving **(University Rank: 1/254)** in the Mechanical Engineering batch across all campuses
- **James Anderson Memorial Prize (2021):** £5000 Monetary Prize awarded for exceptional Merit and Distinction in the Mechanical Engineering batch and for securing the Watt Club Medal

Experience

Research Intern - Machine Learning *Zurich (Remote)*
Atmanirbhar Sashakt Jeevan Sansthan (NGO) *Apr 2025 – Present*

- (Mandatory industrial internship undertaken as part of master's degree requirements at ETH Zurich)
- Finetuned diffusion models using **Low Rank Adaptation (LoRA)** for product photography
- Trained a retention-focused **RAG (Retrieval-Augmented Generation)** WhatsApp Chatbot that answers order related queries, suggests complementary items and triggers post-purchase customer engagements

Graduate Researcher *Zurich*
Robotics and Perception Group, University of Zurich *Apr 2024 – Oct 2024*

- **Master Thesis:** State-Space Models for Efficient Reinforcement Learning in Quadrotors [GitHub]
- Proposed the first SSM-based RL framework for Autonomous Drone Racing for both state-based and vision-based domains
- Developed a custom PPO JAX-Implementation to train the policies for the Flightmare Simulator
- Achieved SOTA performance – **8–10% faster lap-times** in comparison to existing drone racing policies on the Flightmare Simulator by effectively capturing and utilizing the rich temporal information embedded in the drone racing environment
- Achieved **50% faster inference times** in comparison to existing drone racing policies on the Flightmare Simulator

Graduate Researcher *Zurich*
Robotics and Perception Group, University of Zurich *Aug 2023 – Dec 2023*

- **Semester Thesis:** Pushing the Limits of Optical Flow Estimation for Event Cameras [GitHub]
- Proposed the first multi-event learning based optical flow framework for event-based vision
- Achieved **SOTA performance** on event-based datasets such as DSEC-Flow and MVSEC

Skills

Programming Languages: Python, MATLAB

Machine Learning Frameworks: PyTorch, JAX

Packages: NumPy, SciPy, Scikit-Learn, Matplotlib, Pandas, OpenCV, Git, Docker, Hugging Face

Technical: Computer Vision, Machine Learning, Reinforcement Learning, Neuromorphic Vision, Deep Learning, State-Space Models, Sequence Modeling, Diffusion Models, LLMs

Languages: English (C2), Tamil (C2), Hindi (C1)

Publications

Perturbed State Space Feature Encoders for Optical Flow with Event Cameras Jun 2025
Gokul Raju Govinda Raju, Nikola Zubić, Marco Cannici, Davide Scaramuzza [arXiv]
IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), Nashville, 2025

Projects

Spaceship Obstacle Avoidance and Trajectory Planning *Nov 2024 – Dec 2024*
Planning and Decision Making for Autonomous Robots Project [GitHub]

- Implemented a **SCvx (Successive Convexification)** planning and control algorithm for a 2-D spaceship to effectively avoid static obstacles (planets) & dynamic obstacles (satellites) and to dock with the docking station

Robust Soccer Ball Detection and Tracking (FIFA) *Mar 2023 – Jun 2023*
3D Vision Project [GitHub]

- Developed an end-to-end pipeline to effectively detect & track soccer balls in both sharp and blurred broadcast frames.
- Generated a synthetic dataset with Google Research Football Simulator and implemented transfer learning on the YOLOv8n object detection model to achieve a **216% increase in precision (0.31 to 0.98)** and **717% increase in recall (0.12 to 0.98)** compared to the base model.
- Integrated the fine-tuned detection model with a state-of-the-art approach, Motion-from-Blur (MfB) to handle high-speed blurry motion.
- Combined multi-view detections with camera pose information to triangulate the position of the soccer ball **(95.78% tracking accuracy at 0.75 IoU)** and visualized the tracking results by generating 3D trajectories for coaching analytics.

Fault Diagnosis of Rolling Element Bearings using Artificial Neural Networks *Sep 2020 – Apr 2021*
Bachelor Thesis

- Developed a novel approach to diagnose and classify different faults in Rolling Element Bearings (REBs)
- Utilized a benchmarked vibration dataset to train a Discrete Wavelet Transform based Artificial Neural Network on MATLAB
- Optimized the neural network to achieve a **classification accuracy of 100%** and an **accuracy of 99.64% in estimating the magnitude of faults** induced in the REBs

ATLAS-D: Industrial Autonomous Robot Vacuum *Sep 2020 – Mar 2021*
Industrial Project

- Collaborated with EGA (Emirates Global Aluminum) to design a functional CAD Design for an industrial autonomous robot vacuum to clean substations
- Developed a CAD Design of the robot vacuum and implemented an algorithm assisted by LIDAR Sensors and IR sensors on ROS, Gazebo, and Rviz for the robot to map an arbitrary environment and for navigation purposes
- Designed a 4-Stage Dust Separation System consisting of a multi-cyclone separator coupled with HEPA grade washable filters and a custom 3-D printed impeller operated by a BLDC motor to maximize the cleaning efficiency
- Forecasted the demand (number of units) of industrial robot vacuums in the MEA region by adopting a Seasonal ARIMA (Autoregressive Integrated Moving Average) model of the historical sales data of a major company
- Performed a critical analysis to determine the most feasible manufacturing process for each component of the robot vacuum and devised a manufacturing schedule for large-scale manufacturing using MRPs, MPSs, and CRPs
- Developed a model of the production process on WITNESS Horizon to justify the feasibility of the proposed manufacturing process plan

Honors and Awards

UAE Golden Visa for Academic Excellence (2022-2032): Received the prestigious UAE Golden Visa for academic excellence

Eric Gibb Prize (2020): Certificate and £100 Monetary Prize awarded to the student securing the highest total marks in the Mechanical Engineering batch

Deputy Principal's Award (2021, 2019): Awarded for securing straight A's in all modules in the year

Heriot-Watt Merit Scholarship (2018): AED 30,000 Scholarship and direct Year-2 undergraduate entry for exceptional high school results