Gokul Raju Govinda Raju

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EDUCATION

ETH, Zürich   **2022 – Present**
Master of Science in Robotics, Systems & Control
- *Courses*:* Robot Dynamics, Image Analysis & Computer Vision, Dynamic Programming & Optimal Control, Autonomous Mobile Robots, 3D Vision, Introduction to Machine Learning
- *Intended Internship Start Date:* February, 2025 (onwards)

Heriot-Watt University, Dubai   **2018 – 2021**
Bachelor of Engineering in Mechanical Engineering (University Rank: 1/254) (GPA: 4.0/4.0)
- *Watt Club Medal (2021):* Awarded to the student securing the highest total marks and achieving Rank 1 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.
- *Deputy Principal's Award (2021,2019):* Awarded for securing straight A's in all modules in the year.
- *Eric Gibb Prize (2020):* Certificate and £100 Monetary Prize awarded to the student securing the highest total marks in the Mechanical Engineering batch.
- *Heriot-Watt Merit Scholarship (2018):* AED 30,000 Scholarship and direct Year-2 undergraduate entry for exceptional high school results.

The Indian High School, Dubai   **2008 – 2018**
- *All India Senior School Certificate Examination:* 96.2% (Aggregate)
- *Core Courses:* Physics – 95, Chemistry – 95, English – 95
- *Elective Courses:* Mathematics – 97, Computer Science – 99

EXPERIENCE

Robotics and Perception Group, University of Zurich   **April 2024 – October 2024**
Research Student
- *Master Thesis:* State-Space Models for Efficient Reinforcement Learning in Quadrotors
- 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 drone racing 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.

Robotics and Perception Group, University of Zurich   **August 2023 – December 2023**
Research Student
- *Semester Thesis:* Pushing the Limits of Optical Flow Estimation for Event Cameras
- 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.

Heriot-Watt University, Dubai   **September 2021 – August 2022**
Teaching Assistant
- Tutored Undergraduate (Year 2) Robotics students on CoppeliaSim.
- Tutored Undergraduate (Year 1 and Year 2) Mechanical Engineering students on ONSHAPE (Cloud-based CAD Software) and SimSolid (Cloud-based Structural Analysis Software).
- Mentored 40 students in the Mechanical Engineering batch (Year 2) in which teams design a 3D CAD Model of a Gravity Bike to be used at the Paralympic Games by para-cycling competitors.

- Provided laboratory demonstrations in fluid mechanics, mechanics of materials, control systems & dynamics, thermodynamics, and fabrication for over 150 Mechanical Engineering Undergraduate students.
- Provided students with training on Engineering Drawings & graded laboratory reports, and design reports.

RESEARCH PROJECTS

Academic Projects

Robust Soccer Ball Detection and Tracking (FIFA)   **February 2023 – June 2023**

3D Vision Project
- Developed a pipeline to generalize detection and tracking of soccer balls across both blurred and non-blurred frames.
- Utilized Google Research Football Simulator to extract dataset which was used to train a YOLOv8n model to accurately detect soccer balls and integrated the trained network with an existing state-of-the art approach MfB (Motion from Blur) to track fast moving blurry objects across frames.
- Obtained the ball detections from the (YOLOv8n + MfB) model for a custom FIFA dataset and combined it with camera pose information to triangulate the position of the ball and subsequently visualized the tracking results by generating 3D trajectories for the test video.

Fault Diagnosis of Rolling Element Bearings using Artificial Neural Networks   **September 2020 – April 2021**

Undergraduate Final Year Project
- 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 and 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   **September 2020 – March 2021**
- Collaborated with EGA (Emirates Global Aluminum) to design a functional CAD Design for an industrial autonomous robot vacuum to clean substations.
- Develop 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.

SKILLS

Programming Languages: Python, MATLAB
Machine Learning Frameworks: Pytorch, JAX
Packages: NumPy, SciPy, Scikit-Learn, Matplotlib, Pandas, OpenCV
Technical: Computer Vision, Machine Learning, Reinforcement Learning, Neuromorphic Vision, Deep Learning, State-Space Models
Language: English (Bilingual proficiency), Tamil (Native proficiency), Hindi (Professional working proficiency)

HONORS AND AWARDS

UAE Golden Visa for Academic Excellence (2022-2032): Received the prestigious UAE Golden Visa for academic excellence.
Shortlisted Finalist Certificate in the CERN Global Webfest (2021): Awarded for securing a spot as a shortlisted finalist on the CERN Global Webfest 2021.
Certificate of Distinction and School Champion in the Euclid Contest (2018): Awarded for securing the highest marks in the school on the Euclid Contest organized by CEMC, University of Waterloo.