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EDUCATION

University of Maryland (UMD) | *M.Eng. in Robotics* *College Park, MD, US* | **(08/21 – 05/23)**

- Relevant Coursework: Manufacturing Robotic Software, Planning, Advanced Perception, Robot Modeling, Control Systems, Rehabilitation Robots, Deep Learning Frameworks, Hands-on Aerial Robotics.
- Cumulative **GPA**: 3.97/4.0

National Institute of Technology, Calicut (NITC) | *B.Tech in Mechanical Eng.* *Kerala, India* | **(07/16 – 05/20)**

- Relevant coursework: Automobile Engineering, CAD/CAM, Manufacturing and Machine Design.

SKILLS

Programming Languages: C++, Python, Matlab

Tools & libraries: Gazebo, Solidworks, OpenCV, ROS 1, ROS 2, PyTorch, git, Docker, PX4, Arduino, ANSYS, MS Office

Controls: PID, LQR, LQG, Kalman Filter, EKF, Impedance Control

Deep Learning Models: Neural networks, CNN, VAE, RNN, Transformers

EXPERIENCE

3D Modeling Researcher | *Google - Contract (Bayone Solutions)* *Mountain View, CA, US* **| (09/23 – Present)**

- Investigating human variability for Pixel wearables leveraging **3D scans**, under Google's UX team.
- Evaluating various **scanners** and improving the **perception pipeline** to extract key anatomical features.
- Optimizing sensor and hardware design of future Pixel products with data-driven insights from scan analysis.

Research Assistant for SPOT | *University of Maryland* *MD, US* **| (01/23 – 05/23)**

- Integrated ROS packages and sensors for **localization** of robot dog for **autonomous outdoor navigation**.
- Interfaced sensors such as **GPS**, **IMU**, **LiDAR**, and **stereo cameras** using Jetson Xavier.
- Studied different **sensors** and developed algorithms for **contactless vital signs** detection for triage.

PROJECTS

Hands-on Aerial Robotics [LINK] | *PX4, ROS, C++ (Team)* *UMD* **| (05/23)**

- Mastered quadrotor fundamentals using the **ModalAI** m500 kit: (**IMU**, **monocular** camera, 1D LiDAR).
- Introduced **FOLLOW ME** mode, enabling real-time detection and tracking of humans traveling up to **1m/s**.
- Programmed **PD** controllers for precise **yaw** and **depth** control, using **YoloV5 and LiDAR** output.
- Achieved steady-state standard deviation of 0.09° and 0.004m for Yaw and Depth, respectively.

Anomaly Detection in video surveillance [LINK] | *PyTorch, seaborn (Team)* *UMD* **| (10/22 – 12/22)**

- Detected human action-based anomalies using **3D convolutions (I3D)** as feature extractor.
- Trained **Multi-Task Variational Auto-Encoder** (VAE) to generate pseudo features in **weakly supervised** setting.
- Augmented recent works which used **Attention mechanisms** with these pseudo features.
- Tested model on ShanghaiTech & UCF-crime datasets, achieving **improved AUC**: 96.85% and 83.28%.

First Principles of Computer Vision [LINK] | *numpy, matplotlib (Individual)* *UMD* **| (09/22 – 12/22)**

- Implemented fundamental concepts: Edge detection, **Keypoints estimation** using corners, **Optical Flow** using Lucas-Kanade algorithm, **Iterative Closest Point** using Affine Transforms and Image Stitching.
- Executed **Structure from Motion**, **Stereo vision** using **Epipoloar Geometry** and depth map estimation, **Superpixe**l segmentation and scene segmentation using Gaussian Mixture Model.
- Performed transfer learning-assisted **Semantic Segmentation** on VOC2007 images, with VGG16 backbone and **FCN-32** model. Final pixel-wise cross entropy loss was 0.89.

Deep Learning Fundamentals [LINK] | *Python, numpy, PyTorch (Individual)* *UMD* **| (09/22 – 12/22)**

- Executed DL basics: **k-nearest** neighbor, **Support Vector Machine, Softmax** Classifier, 2-layer neural network.
- Implemented CNN with **batch norm, dropout** using both numpy and Pytorch for image classification on CIFAR-10 dataset and achieved accuracy of 72.58%.
- Trained model capable of generating novel captions for images by implementing **Recurrent Neural Networks**.

Agile Robotics for Industrial Automation Competition (ARIAC) [LINK] | *C++, Gazebo (Team)* *UMD* **| (01/22 – 05/22)**

- Formulated a complex control system to handle **kitting** and **assembly** operations in automated warehouse.
- Manipulated robotic arms (**on linear rail and gantry robot**) using Moveit! and **AGV** using ARIAC plugins.

- Monitored environment using **cameras** and addressed various agility challenges.
- Created a competitor ROS package with **multithreading** and emerged **victorious** out of the 6 teams.

A-star implementation with non-holonomic constraints [LINK] | *Python, ROS (Individual)* *UMD* **| (01/22 – 02/22)**

- Designed a 2D environment with obstacles using matplotlib and implemented algorithm for a circular robot.
- Programmed an **open loop controller** in ROS and effected it on actual turtlebot3.
- Traversed the **physical map** quickly, earning a **top 5 rank** among competing teams.

Control of a Gantry Crane [LINK] | *Matlab (Individual)* *UMD* **| (12/21)**

- Developed **LQR** controller for a crane suspending two masses to minimize oscillations.
- Derived motion equations, linearized the model, and performed controllability and observability checks.
- Deployed **Kalman filter** for state estimation and implemented **LQG**.

Design of Test Rig to characterize Braking in LHB [LINK] | *SolidWorks, ANSYS (Team)* *NIT Calicut* **| (07/19 – 06/20)**

- Designed a system model to match the energy dissipated during the braking of LHB coaches.
- Implemented gear system which resulted in **65% mass reduction** of test rig.
- Researched and developed a contactless system to measure the brake torque.

EXTRA CURRICULAR ACTIVITIES

- Developed **quadrotor** for NIST's Indoor Challenge and secured $100K grand prize. (UAS 4.0) *UMD* **| (2023)**
- Supervised gaming stalls at Ragam (one of the largest cultural fests in India). *NIT Calicut* **| (2019)**
- Volunteered in Kerala flood relief campaign. *India* **| (2018,2019)**