Rohan Maan

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ABOUT ME

I am a graduate robotics student with a proven record of designing and building robots from the ground up, proficient in embedded systems development. My current focus lies in the realms of computer vision and path planning, where I'm dedicated to pushing the boundaries of autonomous robotics. With a passion to solve problems, I aspire to apply my skills to the exciting field of Generative AI, aiming to address and solve the issue of hallucinations and data biases.

EDUCATION

Master of Engineering – Robotics *May 2024*

University of Maryland, College Park

Courses: ***Computer Processing*** *of Pictorial Information, Advanced Techniques in* ***Visual Learning and Recognition****,* ***Perception*** *for Autonomous Robots,* ***Planning*** *for Autonomous Robots,* ***Robot Learning, Robot Modelling*** GPA 3.66/4.0

Teaching Assistant: *ENPM645: Human Robot Interaction (Fall 2023)*

Research Assistant: *Perception and Robotics Group (Spring 2023)*

Bachelor of Technology – Robotics and Automation Engineering - Mechanical *May 2022*

Maharashtra Institute of Technology - WPU, Pune, India

Courses: *Machine Vision Systems, Artificial Intelligence, Unmanned Aerial Vehicle, Robotic System Simulation* GPA 9.13/10

Achievements: *ABU Robocon 2020 National Winners (out of 86 teams)* Link

Clubs: *MIT Robocon Tech Team (March 2018-May 2022)*

EXPERIENCE

Big Data and Vision Intern, United States Department of Agriculture - ARS, Arizona *July 2023 – Present*

- Developed **Tillage mapping** algorithm using NASA HLS (Harmonized Landsat Sentinel-2) satellite data.
- Developed cloud cover **inpainting** algorithm using classical vision (spatial averaging)
- Developing cloud cover inpainting algorithm using **Masked AutoEncoders based on Transformers**.
- **Publication** on Tillage mapping in progress.

Undergraduate Research Fellow, I-Hub Foundation for Cobotics, Delhi, India *July 2021 – April 2022*

- Received fund grant of **$18,000** to perform POC of **Photogrammetry** to classify **land infringement** under READY program.
- Performed **3D reconstruction** from images captured using custom quadcopter. Link
- Worked with **OpenDroneMap** to produce 3D meshes, used for **occupancy area estimation**.

Research Intern, Indian Institute of Technology, Delhi, India *July 2021 – March 2022*

- Trained an **Object detection model (Mask RCNN)** for an aerial manipulator to classify the object to be picked midflight. Link
- Performed pose estimation of drone using **ArUco** markers and implemented **PID-based pose correction** before autonomous precision landing with an **accuracy of 1cm** for effective object picking (visual servoing)**.**

Autwn Private Limited, Pune, India March 2021 – July 2021

- Developed **Health Kiosk** to reduce the risk of **Covid-19** spread in offices at peak Covid-19 2nd wave in India. Link
- Designed **embedded system** for automatic opening and closing of **UVC chamber for sanitization**.
- Developed **full stack software** for **automatic attendance** based on **facial recognition (CNN)**, automatic health parameters checking (SpO2 and temperature).

PUBLICATIONS

- K. Kishore et al., "3D Pure Pursuit Guidance of Drones for Autonomous Precision Landing," 2022 13th Asian Control Conference (ASCC), Jeju, Korea, Republic of, 2022, pp. 2218-2222, doi: 10.23919/ASCC56756.2022.9828198. Link
- D. Sarkar et al., "Development of an Autonomous UAV Integrated with a Manipulator and a Soft Gripper," 2022 13th Asian Control Conference (ASCC), Jeju, Korea, Republic of, 2022, pp. 2212-2217, doi: 10.23919/ASCC56756.2022.9828332. Link
- D. Dwarakanathan et al., "Aeromechanical Design and Analysis of H-Drone Configuration," 2022 13th Asian Control Conference (ASCC), Jeju, Korea, Republic of, 2022, pp. 2223-2228, doi: 10.23919/ASCC56756.2022.9828119. Link
- R. Maan, A. Madiwale and M. Bishnoi, "Design and Analysis of 'Xenia: The Medi-Assist Robot' for Food Delivery and Sanitization in Hospitals," 2021 2nd Global Conference for Advancement in Technology (GCAT), 2021, pp. 1-7, doi: 10.1109/GCAT52182.2021.9587776. Link
- Harkare, O. and Maan, R., 2021. Design and Control of a Quadcopter. International Journal of Engineering and Technical Research, 10(257), p.05. Link

PROJECTS

Image compression using INR - Link *October 2023*

- Performed image parameterization with 2-layer feed forward network with **PSNR of 22** for **Implicit Neural Representation**
- Overfitted the model on a single bird image and performed **outpainting**.

Superpixels and Image segmentation - Link *September 2023*

- Generated **superpixels** by performing **SLIC from scratch.**
- **Finetuned VGG-16** for **image segmentation** task using SLIC output and respective masks.

Semantic Segmentation of Medical Images using DL *June 2023 - Aug 2023*

- Trained in a model based on **U-Net architecture** to perform **semantic segmentation** of medical images classifying disease cells.

- The model was tested and achieved an accuracy of **average Dice coefficient of 0.85** giving out effective segmentation performance.

3D Reconstruction of Building – Building Rome in a day *April 2023 - May 2023*

- Trained a neural network to **generate 3D model** using multiple 2D images using CNN and unsupervised learning techniques.
- Improved the efficiency of the model using combination of **VSLAM and multi-layer convolution network**.

Multiview Geometry Depth Estimation *Feb 2023*

- Estimated the **fundamental matrix** iteratively (SIFT feature points of two images) using **RANSAC** and **Eight-point algorithm**.
- Estimated the **essential matrix** and decomposed it to obtain the rotation and translation and then **rectified** the images to make the **Epipolar lines parallel** and estimated the **depth maps.**

Image Stitching Using RANSAC - Link *Jan 2023*

- Detected and matched keypoints **(SIFT Descriptors**) in multiple images and then estimated **homography** using **RANSAC** and stitched using **warp perspective**.

Driver Drowsiness Detection *Dec 2022*

- Used pretrained **Haar Cascade classifier** to detect faces and then eyes, this data is fed to Resnet34 model.
- Trained a **Resnet34** based classifier (transfer learning), with eyes as inputs and drowsiness percent with an **accuracy of 96%**.

SKILLS

LANGUAGES: C, C++, Python, R, MATLAB

SOFTWARE Development: OpenCV, PyTorch, Tensorflow, Numpy, CUDA C++, Scikit-learn, Linux, Git, Docker, CMake

ROS/ROS2: Gazebo, Rviz, MoveIT, roscpp, rospy, rosbag, matplotlib, PX4, ArduPilot

EMBEDDED SYSTEMS: RTOS, Atmel 328P, Texas Instruments M4, CAN, I2C, UART, PWM, ADC

ML & DL: Regression, K-NN, Kernel SVM, K-means, RNN, CNN, Transformers, Autoencoders, Q-Learning, LSTM, GAN

COMPUTER VISION: Multiview 3D Geometry, 3D Reconstruction, Optical Flow, Panoptic Segmentation, Generative Models, Inpainting