

Radha Saraf

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EDUCATION

Worcester Polytechnic Institute(WPI)

Worcester, MA | Jan'22 - Dec'23

MS. ROBOTICS ENGINEERING

PUBLICATIONS

Jain, A., Mahajan, M., Saraf, R. (2020). **Standardization of the Shape of Ground Control Point (GCP) and the Methodology for Its Detection in Images for UAV-Based Mapping Applications**. In: Arai, K., Kapoor, S. (eds) Advances in Computer Vision. CVC 2019. Advances in Intelligent Systems and Computing, vol 943. Springer, Cham.

PATENTS

Humanoid Robot, Application Number: 201721015920, (2017)

WORK EXPERIENCE

HUMANE | COMPUTER VISION ENGINEERING INTERN

San Francisco, CA | Jun'23 - Present

- Design, develop and test robust and reliable CV/ML pipelines

SKYDIO | AUTONOMY ENGINEER INTERN- COMPUTER VISION

San Mateo, CA | Feb'23 - May'23

- Improved localization accuracy for Skydio's Visual Positioning System(VPS)

SKYLARK DRONES | PERCEPTION SOFTWARE ENGINEER

Bangalore, INDIA | Aug'18 – Nov'21

Perception for drone data:

- Developed an **object detection** algorithm for GCPs in aerial drone images, combining traditional computer vision tools with a CNN inspired by the LeNet model which resulted in **94.6%** accuracy(F-score).
- Achieved **86%** accuracy in estimating crop count for a farm using **machine learning** techniques(SVM, CNNs).

Drone Mission Planning and Operations:

- Primary **back-end** developer and maintainer for the in-house drone operations management application.
- Created multiple **RESTful** API endpoints and secured them with unit tests.
- Optimized several API routes to achieve **40-80%** reduction in latency using **MongoDB**
- Integrated **Celery** for background processing of time-consuming tasks like drone mission creation, elevation profile generation for areas of interest, etc.

IB HUBS | PRODUCT DEVELOPMENT INTERN

Bangalore, INDIA | May'17 - Jun'17

- Carried out **camera calibration** and **pose estimation** of a 3D object for a Virtual Reality(VR) gaming application.

SKILLS

Languages: Python, C++, Matlab

Technology: Linux, ROS, Gazebo, OpenCV, Git, Docker, MongoDB, AWS(basics), PyCharm, Flask-RESTPlus, Postman, Pytorch

PROJECTS

3D Reconstruction of a scene using SfM and NeRF [Github link](#)

PYTHON, OPENCV, PYTORCH

Reconstructed a 3D scene from a set of images with different view points using CV & DL methods, **SfM** and **NeRF** resp.

Zhang's camera calibration [Github link](#)

PYTHON, OPENCV

Implemented Zhang's camera calibration method which resulted in a mean re-projection error close to **0.5 pixels**. Used **SVD** for getting an initial estimate of calibration parameters and Maximum Likelihood Estimation(**MLE**) for optimization.

Panorama stitching using CV and deep learning [Github link](#)

PYTHON, OPENCV, PYTORCH

Estimated homography between image pairs using **feature correspondences** and **HomographyNet**, a CNN based supervised learning architecture.

Pose estimation of a mobile robot [Video link](#)

OPENCV, C++, ROS

Estimated pose of an autonomous mobile robot using differential-RGB color-space, image processing tools and **SolvePnP** algorithm from OpenCV library with an accuracy of **+/-5 cms**.

Autonomous mobile robot for library maintenance [Video link](#)

PYTHON, ROS, RVIZ

Navigated turtlebot autonomously in a library using SLAM for identifying misplaced books with QR code detection.

Deep q-learning to play breakout [Github link](#)

OPENAI, PYTORCH

Implemented Deep QLearning Network(DQN) to play Breakout for an averaging reward over 40 points in 100 episodes.

Reinforcement learning techniques [Poster link](#)

OPENAI, PYTORCH

Implemented Dueling DQN(DDQN), Asynchronous Advantage Actor Critic(A3C), Proximal Policy Optimization(PPO) techniques on Super Mario Bros. environment.

Planning under nonholonomic constraints [Github link](#)

PYTHON, PYGAME

Developed a kinematic path planner with **nonholonomic constraints** to efficiently park several vehicles.

Graph search algorithms [Github link](#)

PYTHON, PYGAME

Implemented planning algorithms- BFS, DFS, Dijkstra's, & A* on a grid world setup of configurable obstacle density.

PID control of robot manipulator in ROS [Github link](#)

PYTHON, ROS

Used ROS' client-service, publisher-subscriber frameworks for **PID control** of robot manipulator end-effector pose.

Face Swapping [Github link](#)

PYTHON, OPENCV

Used two different approaches to swap faces in a video- Delaunay triangulation and Warping using Thin plate splines. Poisson blending was used to blend the faces.

Probability based boundary detection [Github link](#)

PYTHON, OPENCV

Developed an algorithm which finds boundaries by examining texture and color discontinuities in addition to intensity discontinuities across multiple scales.

E-braille reader [Video link](#)

C++, EAGLECAD

Implemented capacitive touch mechanism for tactile feedback, established serial communication with bluetooth device, and designed a PCB circuit for a working prototype of the **E-Braille Reader** (a portable device that assists the visually challenged in reading).

COURSEWORK

Computer vision, Motion planning, Robot controls, Reinforcement learning

TEACHING EXPERIENCE

- Graduate tutor for MA2071: Matrices and Linear Algebra
- Graduate tutor for ECE2019: Sensors, Circuits and Systems
- Supervised and mentored high school girls throughout a 2-week, math day-camp at WPI, [GirlsTalkMath](#), that explored mathematical concepts in **RSA Cryptography**
- Delivered lectures on **Linear Algebra** for sophomore students as part of the [IvLabs](#) mentorship program.
- Taken workshops on **PCB-designing** and **Basic electronics** for freshman students, under [IvLabs](#), addressing a batch of 100-150 students at a time