

Shivam Sehgal

<https://www.linkedin.com/in/shivam-sehgal-ab4049132/>

Email : ssehgal7@umd.edu

Mobile : +1-240-495-4166

EDUCATION

University of Maryland College Park

MD, USA

Master of Engineering in Robotics; GPA: 4.0/4.0

August 2022 - May 2024

SKILLS

Programming Languages: C++, Python, MATLAB, C, Bash, HTML, UML, URDF

Software and Tools: Linux, Git, Docker, CMake, Valgrind, Doxygen, ROS, Gazebo, Fusion 360, Solidworks

Libraries: OpenCV, TensorFlow, NumPy, SciPy, sklearn, pandas, Matplotlib, GTest, pytest

Domain Skills: Computer Vision, Motion Planning, Machine Learning, Deep Learning, Data Structures, Algorithms

EXPERIENCE

University of Maryland College Park

College Park, Maryland

Research Assistant

Jan 2024 - Present

- Developed an autonomous drone swarm system using Modal AI Starling and m500 drones.[\[Github\]](#)
- Implemented YOLOv5 for real-time m500 drone detection.
- Integrated ToF sensor data with a high-resolution camera and YOLOv5 output for precise positioning of the m500 drone at 15 FPS. Enhanced to 30 FPS using a constant velocity Kalman Filter.
- Designed a control algorithm for Starling drones to autonomously follow the m500 drone.

University of Maryland College Park

College Park, Maryland

Precision Agriculture Researcher

Jan 2024 - May 2024

- Processed overlapping multispectral drone images of the agricultural field to generate orthomosaic maps.
- Implemented NDVI (Normalized Difference Vegetation Index) analysis on multispectral data to identify water stress areas within the agricultural field.[\[Project Drive\]](#)

Lambda Function

San Fransico, California

Mechatronics Intern(Python, ML)

June 2023 - August 2023

- Developed chip load prediction model achieving a 95% accuracy with a low RMSE.
- Performed Exploratory Data Analysis (EDA) leading to identifying key machining data features. This process resulted in a 20% reduction in prediction error compared to initial models.
- Engineered domain-specific features such as Depth of Cut Interaction, Diameter/Flutes, and Diameter/Radial Depth of Cut, contributing to a 15% improvement in model accuracy.

Hero Motocorp, Neemrana

Rajasthan, India

Assistant Manager

July 2019 - August 2021

- Led a team of 60 field associates to achieve daily targets, implementing automation solutions for manual tasks such as automating bolt tightening at One-Way clutch sub-assembly, saving 2-manpower/shift .
- Implemented Defect Detector for automated engine defect classification. Secured an 81.8 percent accuracy in real-time identification of defects during middle inspection, optimizing production efficiency.

ACADEMIC PROJECTS

Real-time obstacle avoidance on a Drone(ROS, Python, OpenCV, numpy, 3D Pose Estimation)[\[Github\]](#)

- Connected real sense D435 depth camera(RGBD) with modal AI voxl flight to get the depth map.
- Implement a computer vision pipeline to generate a U-depth map to segment obstacles by distance.
- Coded a simple C++ controller for obstacle avoidance and successfully executed the trials.

Agile Robotics for Industrial Automation Competition (ARIAC)(ROS2, Python, C++, Yolo)[\[Github\]](#)

- Formulating a reactive architecture to control a UR10 robotic arm for kitting tasks.
- Manipulating robotic arms on a linear rail using Moveit! and AGV using ARIAC plugins.
- Training a YOLO detector to identify parts with an impressive accuracy of 99.6%.

LQR/LQG Control for Double Pendulum on Moving Cart (MATLAB)

- Derived equations and non-linear state-space representation, linearized around equilibrium. Implemented LQR controllers for linear and non-linear systems, and LQG controllers with Luenberger observer, showcasing MATLAB proficiency.

Optimal Control Strategies for a Single-Axis Pointing Model of a Rigid MAV

- Developed and optimized PD and LQG controllers, minimizing the steady-state variance of the pointing angle and control torque.
- Analyzed and incorporated white noise and sensor bias to enhance system robustness.
- Derived transfer functions for optimal noise filtering, ensuring system stability and accurate control responses.

Accurate Pose and Depth Estimation using Stereo Vision (Python)[\[Github\]](#)

- Implemented stereo vision for depth map estimation from two images of the same scene captured from different camera positions. Attained a depth estimation within 2cm of ground truth.
- Conducted camera calibration, estimated poses, rectified images, and computed depth maps using the sliding window method.

3D Scene Reconstruction with Simultaneous Pose Estimation (Structure from Motion) (Python)[\[Github\]](#)

- Applied Structure from Motion (SfM) to reconstruct scenes and estimate camera poses. Carried out essential steps, including feature extraction, matching, outlier rejection, Fundamental and Essential Matrix estimation, and Bundle Adjustment. Achieved a detailed 3D reconstruction with accurate pose estimation.

Shape Formation with Turtlebot Swarm(ROS2 ,C++ ,Python ,AIP)[\[Github\]](#)

- Implemented shape formation algorithms and controlled multiple turtlebots using ROS2 nodes.
- Integrated CI/CD pipelines with GitHub Actions and Codecov and employed TDD and AIP methodologies for robust software development.
- Designed comprehensive UML diagrams and documented the project with Doxygen.

Path planning of Turtlebot3 in obstacle space using A^* algorithm(Python, ROS)[\[Github\]](#)

- Implemented A^* algorithm for path planning of turtlebot3 to move it from start position to goal position while avoiding obstacles and taking into account nonholonomic constraints.