# Ojas Ajitkumar Mandlecha

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## EDUCATION

**University of Pennsylvania** | Master of Science in Robotics | **GPA:** 3.89 / 4.0 — *Aug 2022-May 2024*
- Courses: Computer Vision, Perception, Machine Learning, Deep Learning, Physics-Informed Deep Learning, Path & Motion Planning, Localization & Mapping

**Vishwakarma Institute of Technology** | B. Tech in Mechanical Engineering | **GPA:** 8.94 / 10 — *Aug 2018-Jun 2022*

## EXPERIENCE

**Urban Transportation Associates** | Cincinnati, Ohio — *Jun 2023-Dec 2023*
Algorithms Intern | ML/DL Dept. Lead
- Developed & optimized YOLO-v3 model pipeline for real-time bike detection with 98 F1 score and 100 FPS. Deployed model on Jetson Nano using ONNX, TensorRT and integrated it with GPS data & main CPU using MQTT protocol.
- Integrated 3D stereo camera & GPS data and enhanced passenger counting to an accuracy of 97% through camera calibration, noise reduction, and cloud integration.

**The Robotics Forum** | VIT, Pune, India — *Sept 2019-Aug 2021*
Technical Lead
- Integrated ML/DL technologies, deploying a YOLOv5-Tiny model on Jetson Nano with TensorRT for real-time ball detection in challenging environments.
- Developed ML-driven distance estimation algorithm with data analysis for enhancing trajectory prediction. Conceptualized, designed, & executed various mechanisms and robots, leading cross-functional teams while representing the university.

## ACADEMIC PROJECTS

**Image Segmentation and Object Detection** | *Computer Vision, Deep Learning*
- **SOLO**: Implemented end-to-end instance segmentation pipeline from: '*Segmenting Objects by Location*' to classify and generate masks for 3 categories (Vehicles, People, Animal) on COCO dataset. | [github]
- **YOLO**: Implemented network from: '*YOLO: Real-Time Object Detection*' to predict bounding boxes over 3 categories. Found location of object and classified using semantic labels. (mAP = 0.74) | [github]
- **SegFormer**: Implemented the SegFormer-BO from: '*SegFormer*' that combines transformers with lightweight multilayer perceptron (MLP) decoders to segment semantically over 3 distinct categories, achieving a 0.35 MIoU. | [github]

**BEV Semantic Segmentation System** | *Computer Vision, Deep Learning* | [github]
- Developed IPM-based system to obtain BEV images from multi-view camera images segmented semantically by building a Segformer pipeline.
- Implemented a U-Net architecture featuring homography-enabled Transformers with a multi-input encoder-decoder framework & achieved a 55.31% MIoU.

**Text-driven Dynamic Virtual Background** | *Computer Vision, Deep Learning* | [github]
- Implemented a Stable diffusion based Text2Scene pipeline, achieving a 67 % improvement in consistent scene generation & generated panoramic images with photo realism rated at 8/10.
- Optimized the Neural Radiance Fields (NeRF) pipeline by introducing cross-patch attention mechanisms resulting in 12.8% increase in FID score.

**Localization and Estimation** | *SLAM, Motion Planning* | [github]
- Developed a Quaternion-based Unscented Kalman Filter (UKF) to track 3D orientation using IMU.
- Integrated the inertial orientation and odometry with a 2D LIDAR scan to localize the robot using Particle Filter to build the occupancy grid map.

**Autonomous VIO-based Quadrotor** | *VIO, Sensor Fusion, Path Planning*
- Implemented Dijkstra and A* algorithms to compute a collision-free trajectory in a 3D environment and developed a nonlinear geometric controller to stabilize the quadrotor.
- Built an Error State Kalman Filter (ESKF) for pose estimation of the quadrotor using IMU and stereo pair sensors.

**Robotic Gripper Arm** | *Robotic Manipulation, Motion planning*
- Developed a software algorithm for a robotic Franka Emika Panda Arm using forward and inverse kinematics, object detection and identification (AprilTags), pose estimation and obstacle avoidance to stack static and dynamic blocks.
- Tested the algorithm in simulation environment (Gazebo) as well as on the Franka Emika Panda.

**3D Reconstruction From Multi-View Images** | *Computer Vision* | [github]
- Performed SIFT for feature matching and used RANSAC for robust camera pose estimation. Computed a 3D point cloud from images using Structure from Motion and Bundle adjustment.

**Others**
- Design, Fabrication and Control of an Ornithopter | *Biomimicry, CFD, FEA* | [github]
- Applying Filters based on Human Emotion | *Computer Vision, Deep Learning* | [github]
- Canny Edge Detection • Laplacian Blending • Homography Estimation • Image Morphing • Poisson Image Editing | ⦿

## SKILLS

**Programming Languages**: Python, C, C++, MATLAB
**Frameworks & Libraries**: PyTorch, ROS, Gazebo, Pandas, Keras, TensorFlow, NLTK, NumPy, OpenCV, matplotlib, Sklearn
**Developer Tools & Technologies**: Linux, Git, VS Code, CUDA