Ayush Goel

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Education

- **University of Pennsylvania** — Philadelphia, PA
  Master of Science in Robotics Engineering | *GPA: 3.9* — May 2024
  Coursework: *Deep Learning, Machine Learning, Geometric Computer Vision, Advanced Robotics, Reinforcement Learning*
  Position: *Teaching Assistant for Data Structures, Algorithms and Software Design*
- **Thapar Institute of Engineering and Technology** — Punjab, India
  Bachelor of Engineering - Mechatronics Engineering | *GPA: 3.89* — June 2018

Skills Summary

- **Programming**: C++, Python, JAVA, Bash, Shell Scripting, AWS, ElasticSearch
- **Tools**: Git/GitHub, Docker, Jenkins, SQL, Maven, MongoDB
- **AI/ML/Robotics**: ROS, OpenCV, PyTorch, scikit-learn, pandas, TensorFlow, Gazebo, Sensor Fusion, CARLA
- **Others**: Linux, macOS, Windows, Microservices, Apache Tomcat, Data Structures, Algorithms

Research Experience

- **Programme in Autonomous Robotics** | *ROS, Computer Vision, Pattern Recognition* — Delhi, India
  Research Intern, IIT Delhi — Jan 2017 - July 2017
  - Designed & developed **Semi-Autonomous Mobile Robot** from **scratch** capable of moving autonomously or teleoperated, with **live video surveillance** & **face recognition** for security using **Haar cascades**.
  - Improved odometry with caliberation, controllers and IMU & encoder infused data using **Kalman filter**.
  - Implemented ROS Navigation Stack to map surroundings & Pattern Recognition to identify medical equipments.

Work Experience

- **Unicommerce eSolutions Pvt. Ltd.** — Gurugram, India
  Senior Software Development Engineer — Aug 2019 - July 2022
  - Responsible and decision-maker of **critical deliverables for high & low-level design changes** and ensuring **robust end-to-end architecture** of the platform.
  - Served as **Team Lead** and **mentored & managed** team of Software Engineers & ensured shipping of high-quality products; fulfilling **80%** more business requirements per sprint.
  - **Reduced** cost of infrastructure by **25%** by redesigning integrations for **optimal bandwidth utilization** and implementing **load distribution, IP-rotation**, and **fallback**.
  - Implemented **MLOps** processes to streamline deployment & monitoring of machine learning models in production environments; boosting revenue by **30%**.

Perception and Deep Learning Projects

- **Segmentation and Object Detection** | *Deep Learning, YOLO, SOLO*
  - **YOLO:** Implemented YOLO-v1 to predict bounding boxes and classes for detecting People, Vehicles and Traffic Lights, achieving **MAP** of **0.45**
  - **Faster RCNN:** Implemented a 2-stage RCNN based object classifier. This involved training the first stage Region Proposal Network and second stage regressor, and classifier, achieving **MAP** of **0.76**
  - **SOLO:** Implemented the network proposed in paper: Segmenting Objects by Location to predict instance segmentation masks over 3 categories(Vehicle, People Animals) on COCO dataset, achieving **MAP** of **0.46**.
- **Stereo Visual Odometry** | *Geometric Computer Vision, C++, Ceres, KITTI, SLAM*
  - Extracted features from stereo images using **GFTT** and performed **triangulation** for 3D point location.
  - Implemented **Optical Flow** for pose and feature estimation and **Bundle Adjustment** for backend optimization.
- **Dynamic Obstacle avoidance for Self-Driving Car** | *DeepLearning, LSTM, PINN, CARLA*
  - Implemented **Social LSTM**, **OLSTM** and **GRU** for predicting pedestrians' trajectory.
- **Bird's Eye View using Egocentric RGB images** | *ImageSegmentation, LaneDetection, YOLOP*
  - Performed **Instance Segmentation** with **72% IOU score** for detecting social agents using **Mask RCNN, Resnet50** and performed **YOLOP** on the masks for Drivable Area Identification.
  - Evaluated Optical flow using the bounding boxes and measured **time to collision**.
- **Localization and Estimation** | *Unscented Kalman Filter, Sensor Fusion, State Estimation*
  - **Orientation tracking with inertial data:** Implemented a Quaternion based Unscented Kalman Filter(UKF) to track 3D orientation from Gyroscope, Accelerometer and Vicon data.
- **Vision-based SLAM**
  - Implemented **2-view** and **multi-view stereo** algorithms to convert 2D viewpoints into 3D reconstruction
  - Used **Tracking** and **Pose Estimation** to place several virtual object models in real world by estimating camera poses using **Perspective-N-Point**; and **Persepective-three-point & Procrustes problem.**

Self-Learned Courses

Autonomous Mobile Robots, *Robotics Specialization*, *ROS*, *Machine Learning*, *Image Processing and Deep Learning*