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; and Operating Systems*
- **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, Object-oriented design

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 controllers and IMU & encoder infused data using **Kalman filter**.
  - Implemented **ROS Nav 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.
  - Integrated **AWS EventBridge** to receive **events** from **downstream systems** and route them to target **AWS Simple Queue Service (SQS)**, thereby reducing API calls by **25%** and increasing efficiency by **30%**.
  - **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

- **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 & feature estimation and **Bundle Adjustment** for backend optimization.
- **Semantic Segmentation using Efficient Spatial Pyramid Network** | *Deep Learning, Segmentation*
  - Implemented a **fast and efficient** convolutional neural network that leverages an **efficient spatial pyramid of dilated convolutions** for semantic segmentation of high resolution images under **resource constraints**.
  - The network is **180 times smaller** and **22 times faster** (on a typical GPU) than the most state-of-the-art semantic segmentation network, PSPNet.
- **Autonomous VIO-based Quadrotor** | *A* path planner, VIO, Kalman Filter*
  - Designed and implemented a **nonlinear geometric controller** with **A* path planning** and generated a **minimum-snap trajectory** after **Ramer-Douglas-Peucker downsampling**.
  - Deployed **Visual Inertial Odometry** to estimate state using **Error State Kalman Filter**.
- **Bird's Eye View using Egocentric RGB images** | *Instance Segmentation, Machine Learning*
  - 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.**