

# Ayush Goel

✉ aygoel@seas.upenn.edu | 🌐 ayushgoel24.github.io | 📞 +1 (267) 231-6755 | 🐙 ayushgoel24 | 🌐 ayushsgoel

## EDUCATION

- **University of Pennsylvania** Philadelphia, PA  
• *Master of Science in Robotics* | GPA: 3.83 May 2024  
*Coursework:* Full Stack Deep Learning, Machine Learning, 3D & 2D Computer Vision, Advanced Robotics, Reinforcement Learning, State Estimation, Internet & Web Systems, Software Systems, Operating Systems  
*Position:* Teaching Assistant for Data Structures, Algorithms and Software Design; and Operating Systems

## SKILLS SUMMARY

- **Programming:** C++, Python, JAVA, Shell Scripting, AWS, ElasticSearch, CUDA
- **Tools:** Git/GitHub, Docker, Jenkins, CMake, Valgrind, Kafka, SQL, MongoDB, Linux, Microservices, Apache Tomcat, JIRA
- **Robotics:** ROS(1&2), OpenCV, PCL, Eigen, Sensor Fusion, Gazebo, CARLA, Motion Planning, Open3D, Drake
- **AI/ML:** PyTorch, Sklearn, TensorFlow, Tensor-RT, ONNX, Pandas, Numpy, ML Ops

## WORK EXPERIENCE

- **TDK InvenSense** San Jose, California  
• *Robotics Software Engineering Intern* May 2023 - Present
  - Designed an efficient **AWS pipeline** combining IoT, Lambda, and Elastic Search; coupled with ROS2 C++ drivers, resulting in a **50%** surge in data processing speed, **30%** cost savings, and enhanced real-time dashboard.
  - Integrated **ROS2 Nav2** point-to-point navigation for mobile robots using **LiDAR**, **Depth Cameras**, **IMUs** with SLAM toolbox for **Lifelong Mapping** optimized adaptability with **Behavior Trees** for increased efficiency.
  - Crafted a robust object detection system using **NVIDIA Issac SDK**, merging **Depth Camera** imagery with **3D point clouds**, achieving a **60% mAP** and reducing false positives for improved robotic reactions.
- **Unicommerce eSolutions Pvt. Ltd.** Gurugram, India  
• *Senior Software Engineer* Aug 2019 - July 2022
  - Managed & mentored team of Software Engineers as **Team Lead**, delivering high-quality products. Innovated **infrastructure redesign**, leveraging **residential & datacenter** proxies with **load distribution & IP-rotation**, achieving **25%** cost reduction. Introduced self-service optimization tools, notably reducing in support tickets.
  - Led **design & architecture** of a robust platform, overseeing both **high & low-level design** changes, spearheading integration with major international marketplaces like Lazada and Shopee, expanding company's footprint to **7** international regions. Played pivotal role in maintaining in-house DSL for partner system integrations.
- **Capgemini India Pvt. Ltd.** Pune, India  
• *Senior Software Engineer* Sep 2018 - June 2019
  - Spearheaded migration of **Malaysia's CIMB Bank's** financial web app from SOAP to **RESTful APIs** & pioneered development of '**Capbook**', enterprise social media platform using **React & Spring**, serving 500+ employees.
- **Programme in Autonomous Robotics, IIT Delhi** Delhi, India  
• *Research Intern* Jan 2017 - July 2017
  - Engineered **Semi-Autonomous Mobile** robot featuring autonomous & manual movement, with obstacle avoidance, real-time video surveillance, & Haar cascade-based face recognition, integrating touchscreen & audio engagement. 📺

## PERCEPTION AND DEEP LEARNING PROJECTS

- **3D Robotic Navigation using Stereo Visual Odometry** | *Geometric CV, C++, Ceres, KITTI, SLAM* 🐙
  - Extracted features from stereo images using GFTT and performed **triangulation** for 3D point location. Implemented **Optical Flow** for robust pose & feature estimation and **Bundle Adjustment** for backend optimization.
- **Efficient Multi-Scale Context Learning for Semantic Segmentation** | *Deep Learning, Segmentation* 🐙
  - Engineered a **resource-constrained, high-resolution image semantic segmentation** solution using a **fast and efficient** convolutional neural network with a **spatial pyramid of dilated convolutions**.
- **Multi-Sensor Fusion for Real-Time Vehicle Tracking using UKF** | *Unscented Kalman Filter, C++* 🐙
  - Fused **LiDAR** and **Radar** sensor measurements using **UKF** to accurately estimate multiple cars' positions and velocities in real time, validated with consistent **RMSE thresholds**.
- **Bird's Eye View Perception for Robotic Navigation and Obstacle Avoidance** | *Instance Segmentation* 🐙
  - Achieved **72% IOU** in **Instance Segmentation** using **Mask RCNN** and **Resnet50**; applied **YOLOP** for lane detection and drivable areas, evaluating optical flow and time to collision.
- **Vision-based SLAM**
  - Implemented **2-view** and **multi-view stereo** algorithms to convert 2D viewpoints into 3D reconstruction 🐙
  - Implemented **Bundle Adjustment** using **Ceres** on BAL dataset (C++) 🐙
  - 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**. 🐙
- **NeRF based 3D Reconstruction and Novel view Synthesis** | *NeRF, C++, LibTorch, CUDA* 🐙
  - Optimized NeRF implementation using **LibTorch**, leveraging **CUDA acceleration** and **JIT** programming. Trained MLP for 3D position mapping using 2D static scene views; calculated camera parameters, executed ray-based stratified sampling, and applied volume rendering for pixel attributes.