


Ayush Goel

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EDUCATION

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

WORK EXPERIENCE

- **TDK InvenSense** San Jose, California
• *Robotics Software Engineering Intern* May 2023 - Present
 - Integrated ROS2 Nav2-based point-to-point navigation pipeline for mobile robots, fusing **LiDAR**, **Depth Camera** and **IMU** readings to build accurate maps with **SLAM toolbox** to implement **Lifelong Mapping**. Enhanced adaptability through **Behavior Trees**, increasing the task efficiency in varied environments.
 - Developed end-to-end object detection pipeline using **NVIDIA Issac** by fusing **Depth camera images** and **3D point cloud data**, achieving a **60%** mAP, with reduced false positives and improved robotic response time.
 - Architected AWS pipeline using IoT, Lambda, Elastic Search, wrote **ROS2 C++** drivers; achieving **50%** faster data processing time, **30%** less operational costs, better reliability, and live dashboard capabilities.
- **Unicommerce eSolutions Pvt. Ltd.** Gurugram, India
• *Senior Software Engineer* Aug 2019 - July 2022
 - Led and guided a team of Software Engineers as the **Team Lead**, ensuring the delivery of high-quality products and surpassing **80%** more business requirements per sprint.
 - Pioneered the **design, development** and **maintenance** of an **end-to-end architecture** for a **microservice** in Spring Boot to support **synchronous and asynchronous integrations**, increasing efficiency by **50%**.
 - Enhanced system efficiency by **30%** and cut API calls by **25%** using **AWS EventBridge**, routing events from downstream systems to **AWS SQS**. Cut infrastructure costs by **25%** optimizing integrations with **bandwidth utilization, load distribution, IP-rotation, and fallback strategies**.
- **Capgemini India Pvt. Ltd.** Pune, India
• *Senior Software Engineer* Sep 2018 - June 2019
 - Spearheaded Malaysia's CIMB Bank's financial web app transition from SOAP to RESTful APIs. Headed development of Capbook, social media platform crafted using AngularJS & Spring Framework catering 500+ employees.
- **Programme in Autonomous Robotics, IIT Delhi** Delhi, India
• *Research Intern* Jan 2017 - July 2017
 - Engineered a fully-functional **Semi-Autonomous Mobile Robot** featuring autonomous and manual movement, live video surveillance, and face recognition for enhanced security utilizing Haar cascades. 

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 **resource-constrained, high-resolution image semantic segmentation** solution using a **fast and efficient** convolutional neural network with a **spatial pyramid of dilated convolutions**.
- **Unscented Kalman Filter with LiDAR and Radar** | *Unscented Kalman Filter, C++ , Sensor Fusion* 
 - 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 using Egocentric RGB images** | *Instance Segmentation, Machine Learning* 
 - 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.

SKILLS SUMMARY

- **Programming:** C++, Python, JAVA, Bash 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, MLflow