Vaidehi Som

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EDUCATION

University of Pennsylvania | Masters Robotics Engineering (Specializing in CV & DL)	Aug'22 – May'24
Indian Institute of Technology (IIT) Jammu, India | Bachelors Mechanical Engineering	Aug'17 – Jun'21

WORK EXPERIENCE

Perception Navigation Intern | *Rust, Computer Vision, SLAM, Sensor Fusion, Multithread*   May'23 – Dec'23
Zipline (Drone delivery & Logistics), USA
- Improved computer vision **feature detection** by integrating **rolling shutter** in the visual inertial odometry pipeline
- Implemented **incremental adaptive graph batch optimization** in the VIO pipeline serving as ground truth for real-world datasets
- Designed and integrated a comprehensive set of **regression tests**, establishing a robust baseline for the VIO pipeline
- Enhanced VIO initialization process by adding feature **marginalization techniques**, improving stability of system
- Improved **camera calibrations** and **imu extrinsics** by implementing data collection pipeline, **distortion modelling**(fish eye cameras), and performance metrics. included **online calibration** in VIO pipeline
- Adopted advanced **Levenberg-Marquardt** optimizer, resulting in significant improvements in optimization convergence
- **Sensor Fusion**: Implemented fusion of GNSS and VIO in **factor graph** in a **tightly coupled** fashion

Mobile Robotics Software Engineer | *C++, ROS, Startup, Automated Guided Vehicle, Docker*   Aug'21 – Jun'22
Addverb Technologies (Warehouse Automation), India
- Implemented communication protocols(**serial/CAN, UART**) for AMR's **LiDAR** and **IMU** for low-level drivers
- Pipeline creation: Implemented safety relevant **Pure pursuit, Lyapunov(research paper) controller** and safety packages for **navigation** stack using **C++** and **ROS**. Improved odometry with calibration, controllers, and **IMU** using **Kalman filter**
- Achieved a **50%** reduction in testing time through the automation of odometry calibration and sensor testing processes

PROJECTS

Stereo Visual Odometry | *Autonomous Driving, Multi-threading, SLAM, Geometric Computer Vision, C++*   *Results/Code*
- Implemented **Visual SLAM pipeline** for stereo images to find 3D locations of keypoints, used **GFTT** for feature detection and **triangulation** for 3D point location. Implemented **direct method** and **optical flow** for pose and feature estimation during feature tracking and **Bundle Adjustment** for backend optimization using **g2o**

Dense 3D reconstruction from point clouds using Octrees | *C++, PointCloud, Octree, SLAM*   *Results/Code*
- Implemented **octomap::OcTree** for efficient SLAM mapping, opting for a basic octree structure over RGB-enhanced variants to prioritize occupancy information and simplify map construction
- Employed Octomap's **point cloud** to translate RGB-D and camera pose data into world coordinates, updating the octree map's occupancy probabilities, and compressed the final map into an octomap.bt file for visualization with **octovis**

Semantic Segmentation using SegFormers | *Python, Transformers, ResNet-50*   *Results/Code*
- Implemented Segformers, integrating Efficient Self-Attention, Mix-FFN, Overlap Patch embedding, and Dice loss
- Used the 3k images from imbalanced BDD 100K dataset to achieve a Mean Intersection over Union (IoU) score of 77.07%

Multi Object Detection and Tracking | *Python, DeepSORT, YOLO8*   *Results/Code*
- Developed a Multiple Object Tracking System with **DeepSORT** and **YOLOv8**, employed Kalman filtering and the **Hungarian** algorithm for improved data association. Deployment done on NVIDIA Triton Inference Server via Docker optimizing dynamic batching. Converted the model to **TensorRT**, achieving increased throughput and reduced latency on **NVIDIA Jetson Orin**.

Neural Network optimization using Quantization and Pruning | *Python, Deep Learning, KD loss*   *Results/Code*
- Quantized CNN-based architectures to make them **4x** smaller and **2x** faster in Pytorch
- Set up **Knowledge Distillation** to reduce inference time by **12x** and affecting results only by **13%** on segmentation pipeline

RESEARCH PUBLICATIONS

LIV: Language-Image Representations and Rewards for Robotic Control | *Multimodal learning*   *Paper*
*Yecheng Jason Ma, **Vaidehi Som**, William Liang*, Vikash Kumar, Amy Zhang, Osbert Bastani, Dinesh Jayaraman*   *ICML 2023*

Sequential Transfer Learning for human decision making model during Human Robot CoLearning
*Rajul Kumar, **Vaidehi Som**, Ningshi Yao, Submitted to IEEE International Conf on Robot & Human Interactive Communication*

Secure and Privacy Preserving Proxy Biometric Identities | *GANs, Python, DL*   *Paper/Code*
***Vaidehi Som**, Pranav Gunreddy, Harkeerat Kaur, Isao Echizen*   *Springer 2023*

TECHNICAL SKILLS

Programming: C++, Python, Rust, CUDA, Linux, CMake, Git, Docker, VIM, gdb, Git/Github, GTest, Jetson Nano
Robotics: ROS(1&2), OpenCV, Eigen, Sensor Fusion, Ceres, g2o, Sensor Synchronization, Optimization (LM, GN), SLAM, GTSAM
AI/ML: PyTorch, Pandas, Numpy, ML Ops, GPU, scikit-learn, Scipy, Matplotlib, Weights&Biases, TensorRT, Segmentation