P Sai Ramana Kiran

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Senior Algorithms Engineer with domain skills in Computer Vision, Computer Graphics, Deep Learning, Language Processing

EDUCATION

Worcester Polytechnic Institute Aug 2022 - May 2024

M.Sc. Robotics, CGPA: 4.0/4.0 | Courses: **Deep Learning**, Roles: **Teaching Assistant** for RBE549: **Computer Vision**

Indian Institute of Technology Madras Jul 2013 - Jun 2018

(B.Tech + M.Tech), Aerospace Engineering, *CGPA:* 8.41/10 | Courses: **GPU Programming using CUDA**

RESEARCH PUBLICATIONS

Pinnama Raju, R Singh, M Vel, N Sanket. **"EdgeFlowNet: 100FPS@1W Dense Optical Flow For Tiny Mobile Robots"**, IEEE Robotics and Automation Letters (**RA-L**) [Presenting at **ICRA**-2025] Project Page | Video

- Designed **quantizable multiscale deep** optical flow network that can be deployed on edge devices like Google Coral TPU.

S Raju, A Kumar, R Mohan. **"Aerial-Ground Robotic System for Terrain Estimation".** ICC Paper | Gitlab: Flight Stack | Ground_stack

WORK EXPERIENCE

Quidient - Algorithms Team | **Senior Algorithms Engineer**- Computer Vision and Computer Graphics May 2024 - Present

Diffuse and Specular Material Estimation using Diffusion priors

- Working on fusing depth-normal priors for geometry and material estimation using Physics Based Inverse Rendering (PBIR).

Differentiable Ray Tracing Engine for 3D reconstructions - Backpropagation Algorithm, Jacobian Notes

- Developed a **GPU accelerated** differentiable particle ray tracing engine for explicit scene primitives using NVIDIA OptiX.
- Designed a flexible API allowing BVH construction for various radiance and surface representations like 3D gaussians, Dipoles.
- Attained real-time ray tracing performance of 3D Gaussians (**150FPS**) with accuracy matching the original 3DGS (**23 PSNR** on Tanks & Temples dataset).
- Enhanced the reconstruction accuracy of specular surface SDF by **5% PSNR** using unbounded 3D gaussians ray tracer as faux light field emitter instead of slow, low frequency NeRF based MLPs.
- Implemented **low-level CUDA** kernels for differentiable backpropagation, incorporating hand-derived volumetric rendering for ray-particle intersection Jacobians.

Pose Estimation: Custom RGBD SLAM on iPhone and Plenoptic Pose Refinement

- Engineered SLAM module tailored for closed enclosures and object captures as a drop in replacement for ARKit and COLMAP.
- Reduced average specular 3D reconstruction time from **8 hours** to **4 hours**, while also improving the user guidance experience.
- Module runs on-device with low memory footprint (**400MB** of RAM) and high throughput (**60FPS**) at VGA resolution.
- Key technology features: **pose graph optimization** using ceres solver, KLT and ORB based feature tracking and a simple global descriptor based place recognition.
- Implemented a SOTA differentiable pose refinement based on focal pose parametrization and **Camera Preconditioning** module for SLAM captures. Refinement boosts reconstruction accuracy by **20% PSNR** and effectively replaces COLMAP.

Torc Robotics - Road and Lane Team | Computer Vision and Deep Learning Co-op Aug 2023 - Dec 2023

Baseline Shared Encoder Design

- Researched shared encoder designs unifying **road segmentation** and **laneline detection** for optimized resource allocation.
- Unified the data loaders, iteratively implemented designs compatible with **ONNX** format , deployed and profiled on **Orin AGX.**

Nokia Bell Labs | Perception and Localization Intern May 2023 - Aug 2023

Structure Aided Visual Localization

- Built custom **depth correction** algorithms using **Passive Stereo** and **ToF** registration in textureless, repetitive settings.
- Created **automated annotation** pipeline to **fine-tune** YOLOv8 network using Segment Anything Model (**SAM**) and **DINOv2.**

Quantitative Brokers LLC | **Senior C++** Software Developer Jul 2020 - Aug 2022

Profiling, Instrumentation and Messaging Service

- Created a compile time controlled **latency profiler tool** using a shared **ring buffer** to benchmark the C++ program scopes.
- Developed a **Pollable-SHM** transport mechanism for freeing up busy-wait processes using **unix socket handle sharing.**
- Designed a light-weight **multi-threaded** message oriented **middleware** based on **publish-subscribe** model.
- Engineered a template-based **code generator** for nested C++, K and JSON messaging structures **(de)serialization.**
- Developed **language agnostic messaging protocols** using google protobuf for integrating statistical and visualization services.

Quantitative Brokers LLC | C++ Software Developer — Jul 2018 - Jul 2020

EuroNext Market Data Handler

- Developed a low-latency single threaded C++ handler to fetch, parse and publish from **UDP** packets to messages.
- Built **ring buffer** to handle out-of-sequence packets and transport **L**imit **O**rder **B**ook with **shared memory** IPC methods.
- Created **shared libraries** and **plugins** to transform messages from C++ to K structures and store them in KDB.

SKILLS

Programming Languages : C++(11/14/17/20), Rust, Python, JavaScript, SHELL Scripting (BASH, ZSH)
Softwares and Frameworks : GDB, Valgrind, Nvidia Nsight, Pytorch, TensorFlow, CUDA, ROS, Git, OpenCV, MMCV, Docker, Blender
Deep Learning Architectures : ResNet, NeRF, RAFT, Transformers, VectorMapNet, DETR, 3DGRT, NeRO, TSDF Fusion

RELEVANT PROJECTS

STSU++ - Enhanced lane centerlines predictions with multi-view traffic scenes by **extracting BEV features** from **Vision Transformers** - GitHub

Structure From Motion (SfM) and NeRF - Simultaneously reconstructed 3D scene (**M**apping) and extracted camera pose (**L**ocalization) from camera correspondences using (Non)Linear **triangulation**, (Non)Linear **PnP** and Bundle Adjustment (**BA**) pipeline - GitHub

Stereo Visual Inertial Odometry (VIO) - Implemented process model and measurement model components in **M**ulti **S**tate **C**onstrained **K**alman **F**ilter (MSCKF) based stereo visual inertial odometry - GitHub

Auto Pano - Created a **panorama** by stitching images using homography estimated from traditional (**ANMS**, **RANSAC** feature points) and Deep learning (Supervised and Unsupervised **HomographyNet**) methods - GitHub

Auto Calib - Implemented Zhang's camera calibration by **nonlinear optimization** of intrinsics and extrinsics - GitHub

Painting LIDAR Cloud - Built **3D semantic** point cloud map with predicted camera semantic labels using **ICP** and point painting - GitHub

MENTORSHIP

xFeatSLAM - Provided guidance in integrating latest xFeat feature descriptor into ORBSLAM3 - GitHub