Udit Singh Parihar

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Education

International Institute of Information Technology — Hyderabad, India
MS By Research Computer Science; ***GPA: 8.67/10.00*** — *2019 – 2021*

Indian Institute of Technology — Jodhpur, India
B. Tech Mechanical Engineering; ***GPA: 7.1/10.0*** — *2014 – 2018*

Work Experience

Qualcomm — Bangalore, India
Computer Vision, DL and SLAM Research Engineer — *July 2023 – Present*

Improving Qualcomm and Google AndroidXR 6DoF SLAM system:
- Debugged and contributed to C++ codebase maintained by team of 40 engineers in Qualcomm and Google
- Brought down 6DoF accuracy under 5 mm and improvement of 50% in low texture and HDR scenarios
- Made key contribution to detection, stereo triangulation and tracking in VIO

Ground truthing system for Visual Inertial Odometry (VIO):
- Bring up a mechanically constrained hardware solution for determining accuracy of VIO system
- Developed a multi checkerboard setup to estimate the multi camera and IMU pose
- Initiated and developed pipeline to use total station for calculating accuracy of VIO system

Fusing IMU with Camera based deep feature matching (Patent submission):
- First in literature to integrate IMU with camera based deep feature matching
- Solves the problem of matching in low texture environment, high rotation changes
- IMU guided optical flow and occlusion modeling

OLA Electric — Bangalore, India
Computer Vision, DL and SLAM Research Engineer — *July 2021 – July 2023*

Autonomous agent development:
- Developed an end to end autonomous driving agent using cameras, GPS and IMU sensors
- Ported the agent from Carla simulator to NuScenes Dataset
- Converted the pytorch model to TensorRT and developed a ROS wrapper to run on real Mahindra E2O car achieving final control prediction at 25 HZ, in a zero shot paradigm

Lidar based mapping and localization:
- Extended the Lidar based SLAM LeGO-LOAM for the Ouster lidars and ported ROS1 to ROS2 in C++
- Calibrated the Lidar and IMU/GNSS sensors for extrinsic calibration

Kaggle Image Matching Challenge:
- Won the silver medal in the Kaggle Image Matching Challenge 2022
- Developed an Ensemble of Deep feature matching algorithm of SuperGlue and LoFTR

Research Publications

1. **Estimation of Appearance and Occupancy Information in Bird's Eye View from Surround Monocular Images** | *OLA Electric*
   International Conference on Robotics and Automation (ICRA), Autonomy 2.0, ***2022***
   Sarthak Sharma, Unnikrishnan R. Nair, ***Udit Singh Parihar*** *, Midhun Menon S and Srikanth Vidapanakal*

2. **RoRD: Rotation-Robust Descriptors and Orthographic Views for Local Feature Matching** | *IIITH*
   International Conference on Intelligent Robots and Systems (IROS), ***2021***
   Udit Singh Parihar*, Aniket Gujarathi****, Kinal Mehta****, Satyajit Tourani****, Sourav Garg, Michael Milford and K. Madhava Krishna*

3. **Early Bird: Loop Closures from Opposing Viewpoints for Perceptually-Aliased Indoor Environments** | *IIITH*
   International Conference on Computer Vision Theory and Applications (VISAPP), ***2021***
   Satyajit Tourani, Dhagash Desai*, **Udit Singh Parihar***, Sourav Garg, Ravi Kiran Sarvadevabhatla, Michael Milford and K. Madhava Krishna*

4. **Topological Mapping for Manhattan-like Repetitive Environments** | *IIITH*
   International Conference on Robotics and Automation (ICRA), ***2020***
   Sai Shubodh Puligilla , Satyajit Tourani* , Tushar Vaidya* , **Udit Singh Parihar*** , Ravi Kiran Sarvadevabhatla and K. Madhava Krishna*

Projects

Feature matching under extreme viewpoint | *Project Page*
Accepted at IROS 2021

- Proposed rotation invariant deep feature descriptors and matching via orthographic view generation to enhance descriptor quality
- Achieved twice the recall rate in Image Retrieval task and 80 % reduction in Rotation Error compared to state of art

Place recognition from opposite viewpoint | *Paper Link*
Accepted at VISAPP 2021

- Developed a Visual Place Recognition algorithm to detect places from 180^0 opposite viewpoints, using a novel idea to localize based on floor signatures
- Incorporated our VPR pipeline into SLAM system to allow map reconstruction from 180^0 opposite robot viewpoint

SLAM on feature-less environment | *Project Link*
Accepted at ICRA 2020

- Used semantics understanding for assisting loop closure detection and localization
- Implemented our algorithm using libraries RTAB-Map, PCL, g2o, OpenCV on p3dx bot using RGB-D Sensor, IMU and wheel odometry

Tutorial on Pose Graph Optimization | *Project Link*
Teaching Assistant in Mobile Robotics course | Sep 2020

- Created Open source tutorials for 2D pose graph optimization with loop closure and 3D pose graph optimization with landmarks using g2o library
- Obtained more than 50 stars and forks on GitHub for the tutorials

Development of Robotics Toolbox | *Project Link*
Mobile Robotics Coursework | Aug 2019

- Implemented Bundle Adjustment from scratch. Compared performance of Gauss Newton and LM algorithm for optimization
- Implemented Extended Kalman Filter algorithm on the standard *"Lost in the Woods"* dataset

Development of Parallel Computing Toolbox | *Project Link*
Parallel Scientific Computing Coursework | Jan 2019

- Implemented PCA algorithms for image compression using C++/Cuda. Compared performance against MATLAB standard PCA implementation
- Implemented parallel Monte Carlo algorithm for calculation of digits of *PI* using OpenMP and MPI

Skills

Programming: C++, Python, C, MATLAB

Libraries: PyTorch, Keras, CUDA, ROS1/ROS2, G2O, GTSAM, TensorRT

Relevant Coursework

Major coursework: Computer Vision, Mobile Robotics, Topics in Applied Optimization, Introduction to Parallel Programming, Deep Learning Theory and Practices, Probability and Statistics, Programming and Data Structures