Sahib Singh Dhanjal

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Education

University of Michigan, Ann Arbor Aug '17 - May '19

Masters of Science in Robotics | GPA - 3.55/4.00 | **Courses**: Artificial Intelligence, Machine Learning, SLAM, Self Driving Cars, Computer Vision

Birla Institute of Technology and Science, Pilani Aug '12 - May '16

Bachelors of Engineering in Mechanical Engineering | GPA - 9.05/10.00 | **Courses**: Image Processing, Mechanisms in Robotics

Publications

[i] DeepLocNet: Deep Observation Classification and Ranging Bias Regression for Radio Positioning Systems: IROS' 19

[ii] Unsupervised Learning of Assistive Camera Views in Augmented Reality Multitasking Environments: ICRA' 19

[iii] PoseNet++: A CNN framework for online pose regression and robot re-localization

Work Experience

Magic Leap | Google XR: *Sr High Performance Software Engineer (Computer Vision)* Oct '20 – Present

- Engineered a robust, real-time, photometric refinement algorithm for targetless depth-to-camera extrinsics calibration, compensating for upto 0.5º and 1.75mm of deformation due to manufacturing defects that was previously causing world reconstruction failure. The solution was shipped as an OTA update, enhancing device reliability and avoiding a recall of 1500+ devices.
- Led development of a high-precision marker tracking algorithm (1mm error over 50m) for safety-critical surgical applications using photometric refinement. Achieved substantial accuracy improvements over OpenCV only benchmarks (40mm vs 5mm and 12arcmin vs 4arcmin) across 500+ synthetic and real world datasets.
- Developed an online camera intrinsics calibration algorithm, enabling reliable device operation from -5ºC to 80ºC by dynamically compensating for temperature induced focal length changes.
- Optimized the factory calibration pipeline, reducing both triangulation scale error and epipolar error by ~2% through the unification of lens correction and spherical rectification. Other efficiency improvements reduced device calibration time by 50% (~28min vs ~58min), effectively doubling production throughput.
- Developed a unified metrics API, device telemetry API and web dashboard to facilitate data-driven decision-making, benchmarking, and real-time performance monitoring of vision systems. Established a complimentary CI-based automated testing framework (on-device, cloud integration, unit testing) to significantly improve code quality and reliability.
- Developed an extrinsics miscalibration detector for the pose tracking pipeline. The solution proactively detects miscalibrations to trigger online calibration (OC), reducing computational overhead by ~30% per 10 min of device runtime.
- Improved markerless extrinsics camera calibration precision by ~14% using a principled covariance estimation method.
- Keywords – non-linear optimization, online calibration, 3D computational geometry, linear algebra, deep learning, sensor fusion, SLAM, photometric refinement, pose tracking, marker tracking, PyTorch, Python/C++

Magna | Lyft Level 5: *Software Engineer (Deep Learning, Localization and Mapping)* Jul '19 - Oct '20

- Led development of a deep-learning based solution for dirty lens/pedestrian detection on highly constrained ARM DSPs (< 2Mb) achieving ~15FPS. Designed, pruned and quantized the neural network, reducing model size by ~70% with a minimal drop in model accuracy/mAP. Deployed it on CEVA DSPs using ONNX Runtime, ArmNN, and CEVA DNN compiler.
- Developed monocular visual SLAM based auto-pilot/auto parking systems for Tier I/II OEMs achieving 30cm/50m accuracy.
- Implemented a 2.5D lane geometry generation algorithm to create semantic map from OSM (Open Street Map)
- Streamlined HD map validation pipelines, reducing runtime from 24 hrs to < 3 hrs using Flyte, Docker, Botocore and gRPC.
- Keywords – deep learning, pruning, quantization, object detection, sensor fusion, Visual SLAM, ONNX, OSM, Python/C++, gRPC

Research Experience

Perpetual Robotics Lab: *Radio-Visual-Inertial Positioning System, IROS 19* Aug '18 – May '19

- Developed a robust radio-visual-inertial localization framework using a deep learning classifier to distinguish LOS/NLOS radio packets to validate Friis Free Space Model (95% accuracy) for indoor navigation, and published the same in IROS' 19. Conducted simulations in MATLAB/Python and performed real-world experiments on the Fetch Mobile Manipulator to validate the framework.
- Keywords – deep learning, radio localization, Fast SLAM, particle filter, non-linear optimization, ROS, Python/C++, Matlab

Distributed Aerospace Systems and Controls Lab: *NASA Astronet, ICRA '19, TARDEC Project* Apr '18 - May '19

- Developed multi-robot control and localization algorithms using ROS/Gazebo to control swarms of land and aerial robots. Published unsupervised learning approach for augmented vision based robot control for NASA's Astronet Project (ICRA' 19).
- Keywords – unsupervised learning, swarm localization, AR/VR applications, ROS, rViz, Gazebo Python/C++