INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY
HYDERABAD

R&D SHOWCASE 2021
Technology, Social Impact

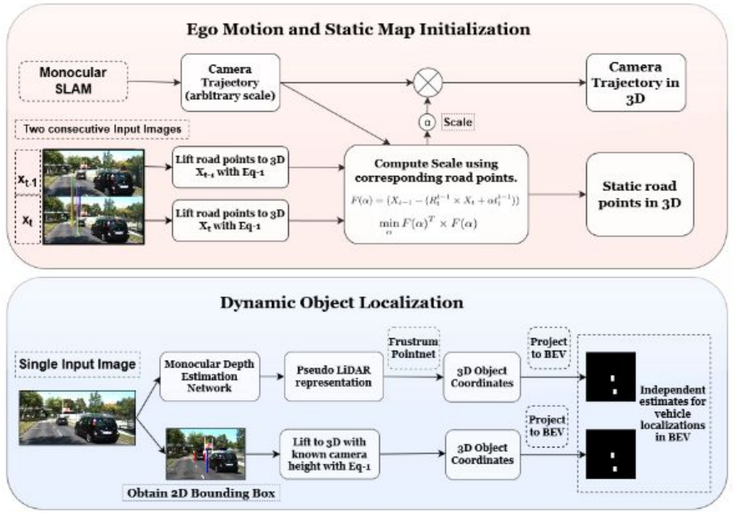
MULTIBODY MONOCULAR SLAM USING POSE-GRAPH OPTIMIZATIONS

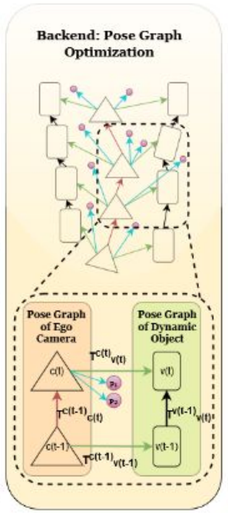
AIM

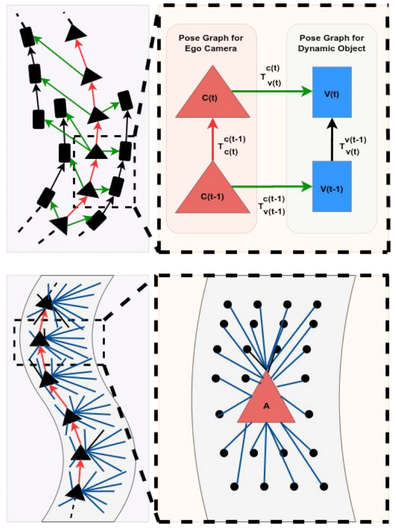
Dynamic scenes are often unobservable as it is impossible to triangulate them unambiguously using a moving monocular sensor. We propose a *factor-graph* formulation that utilizes cues from dynamic and static landmarks in the scene to perform multibody monocular SLAM. We obtain trajectory estimates for the moving ego-camera and various dynamic agents in the scene in a *static global-frame* and in a *single metric scale*.

APPROACH

We represent initial estimates of ego-odometry and vehicle poses as nodes in a pose-graph across all time samples. These are obtained from feature based odometry estimations and 3D vehicle localizations. These nodes are constrained using binary and unary edges among them and stationary landmarks in scene like lane-markings. Timely resolution of this optimization problem provides accurate trajectory estimates on a common map.





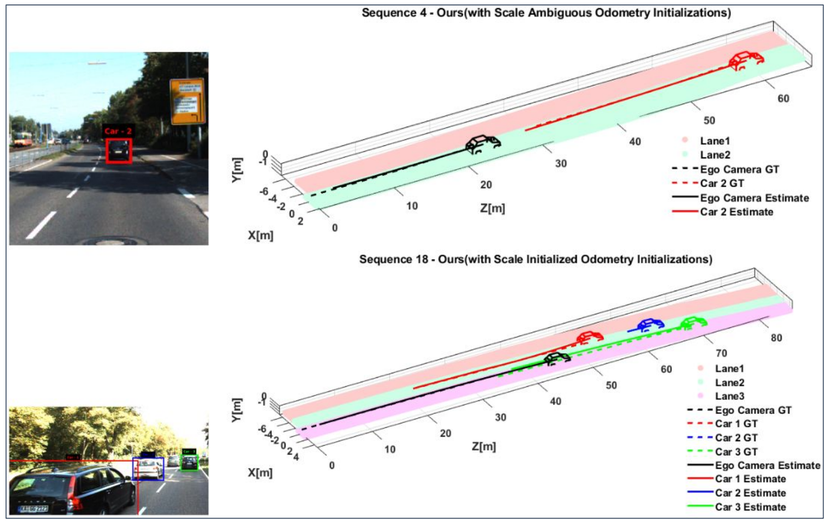


Edges with dynamic features

Edges with stationary landmarks

EXPERIMENTS AND RESULTS

Both incremental and batch optimizations are performed. Incremental version runs at average ~16.3ms for various number of objects in scene. It is observed that accurate localizations and strong landmark estimates can lift odometry estimates from ambiguous scale to known scale in the optimizer itself. Known camera-height is used to ensure all trajectories are obtained in metric scale. A single optimization solution provides accurate estimates for various agents in the scene as well as the ego-vehicle in a common stationary frame of reference.



Authors: Gokul B. Nair, Swapnil Daga, Rahul Sajnani, Anirudha Ramesh, Junaid Ahmed Ansari, J. Krishna Murthy, K. Madhava Krishna

Research Center Name: Robotics Research Center