Progress Report

Bardia Mojra

March 27, 2022

Robotic Vision Lab

The University of Texas at Arlington

1 Specific Research Goals

- VPQEKF (RAL - April 1st): Work on the paper.

- DLO Manipulation Dataset (ICRA - September)

2 To Do

- QEKF Paper - 30% extension (April 1st):

  - Edit VEst section and add updates.

- QEKF/QuEst+VEst Implementation (Feb. 28th):

  - Implement QuEst 5-point: On-going - implementing RANSAC.
  - Feature point extraction: implement semantic segmentation
  - Implement VEst
  - Address scale factor (depth-scale) issues: DL solutions?
  - Address "hand off" issue when objects enter or leave field of view
  - Real-time streaming images for real-time operation (optional)
  - Experiments
  - Noise issue: noise cannot be modeled

- DLO Manipulation:

  - Related work literature review
  - Real dataset + paper (September 2022 - ICRA):
    * Watch IROS manipulation workshop videos. - Done.
    * Design, discuss and build a data collection and test rig.
  - Unity dataset
    * Recreate virtual duplicates of physical test material
    * Model dynamics and deformity

3 Progress

The following items are listed in the order of priority:

- VPQEKF (RAL - April 1st, 2022): I talked to Dr. Gans and he said we are targeting the IEEE Robotics and Automation Letters (RAL) journal for this work. Per his recommendation, I only implemented ϕ_3 metric from [1] as it is the only metric we are interested in. The QuEst algorithm works but it produces inaccurate results by a factor of 100-1000 and it seems as if suboptimal point correspondences were picked for calculating rotation between frames. For this reason, I am now implementing RANSAC similar to Kaveh's original implementation. Next, I will implement *semantic segmentation* for the KITTI dataset and it will be used to extract more consistent point correspondences. It is important to select feature points that are only from stationary objects and background; otherwise, including point correspondences from moving objects will introduce significant errors to pose triangulation.

- NBV-Grasping Project: I am making this a part of the DLO project.

- DLO Manipulation: No update.

- Pose Estimation: I will need it for DLO segment localization.

- PyTorch Tutorials: Transfer learning.

4 Intermediate Goals - Fall 2021:

- QEKF: Finish paper.

- UR5e: Do the tutorials.

References

[1] D. Q. Huynh, "Metrics for 3d rotations: Comparison and analysis," *Journal of Mathematical Imaging and Vision*, vol. 35, no. 2, pp. 155–164, 2009.