

Progress Report

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Robotic Vision Lab

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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):
 - * 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): This week, I worked on implementing a custom RANSAC to obtain a subset of matched feature points that form a consistent linear transformation from one frame to another [1]. The implemented RANSAC uses QuEst pose estimation algorithm to find a fit and returns a rotation value in form of a quaternion. The rotation model is then used to compute the Sampson distance for all other points and find inlier and outlier data points. This process repeats up to a predetermined limit and the model with the least error is returned as the estimated true transformation. The corresponding translation vector is computed after finding the most fitting rotation model from the matched feature points pool.
- DLO Manipulation Milestones: pose estimation and tracking, object detection (semantic segmentation), grasping, assembly and disassembly, and DLO manipulation.
- Pose Estimation (DLO-01): On-going under VPQEKF.
- Semantic segmentation (DLO-02): Per my discussion with Dr. Gans, I will explore DL methods for the depth or scale problem.
- Grasping Project (DLO-03): I am making this a part of the DLO project.
- PyTorch Tutorials: Transfer learning.

4 Intermediate Goals - Fall 2021:

- QEKF: Finish paper.
- UR5e: Do the tutorials.

References

- [1] G. Shi, X. Xu, and Y. Dai, “Sift feature point matching based on improved ransac algorithm,” in *2013 5th International Conference on Intelligent Human-Machine Systems and Cybernetics*, vol. 1, pp. 474–477, IEEE, 2013.