Progress Report

Bardia Mojra

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Robotic Vision Lab

The University of Texas at Arlington

1 Specific Research Goals

- VPQEKF (April 1st): Work on the paper.
- DLO Manipulation Dataset (September - ICRA or IROS?)

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.
  - Implement VEst
  - Address scale factor (depth-scale) issues
  - Address "hand off" issue when objects enter or leave field of view
  - Real-time streaming images for real-time operation (optional)
  - Experiments
  - Feature point extraction
  - Noise issue: noise cannot be modeled
- DLO Manipulation:
  - Related work literature review
  - Real dataset + paper (September 2022 - ICRA):
    - Watch IROS manipulation workshop videos.
    - 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 (April 1st, 2022): This week, I continued working on QuEst rewrite and was able to begin testing the code. It still has many bugs and I am debugging it while stepping through the code and comparing results with Kaveh's Matlab implementation. Per Dr. Gans' instructions, I am omitting RANSAC implementation for now but I have already looked up the RANSAC module by Scipy and it seems straightforward. For the fitting and error routines, he used QuEst and Sampson distance respectively.
- DLO Manipulation: I have an idea for estimation pose and momentum of DLO's that is even simpler than sparse DLO representation. Instead of training a DL model to estimate the *unit segments*, I could simply estimate the pose and momentum of the center of the mass through a voting mechanism. High-performance computing (HPC) should be used to evaluate different alternatives as well, I will expand on this idea later.
- Pose Estimation: I will need it for DLO segment localization.
- NBV-Grasping Project: No update.
- PyTorch Tutorials: Transfer learning.

4 Intermediate Goals - Fall 2021:

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