Progress Report

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April 25, 2022

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: Done, debugging.
  - 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, Cody and I went over the C++ implementation by Kaveh. Based on my observations, I believe he faced similar issues because there are flags to switch between different algebraic decomposition libraries. Dr. Gans and I decided to pivot from the Python implementation as it is taking too long to figure out and we can not guarantee it will have matching accuracy. I started working on the Matlab code this weekend and I am halfway done. I implemented Python QEKF is in complete compliance with object-oriented programming (OOP) best practices which allows for easy and fast source code transfer. In line with that, I figured out, implemented, and tested its OOP syntax. The data management module is implemented and tested. The QEKF module is implemented but not tested and data logging and visualization modules are to be implemented and tested in the next few days. I do get distracted, there is no denying that and I have always appreciated your guidance. Paying attention to things such as OOP is not a distraction rather it is what helps me achieve exponential growth in my productivity while maintaining source code agility and reliability. This is my understanding, I could be wrong.

- DLO Manipulation Milestones: No update other than that Cody asked me if I am open to mentoring the EE robotics team this year and helping him with it. He suggested the National Robotics Challenge (NRC) but it is not meant for Ph.D. students. I will bring up NIST and will ask if they want to help me with my next paper/project and in return, I will teach and explain everything with will give them credit on the final paper(s). It is important to me to build a solid team as well as external alliances. Please advise.

- 3D Scanner: It is needed for object manipulation and perception tasks.

- 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.