Progress Report

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Robotic Vision Lab

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1 Specific Research Goals

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

2 To Do

- QEKF Paper - 30% extension (April 1st):
  - Read QuEst and VEst again.
  - Edit VEst section and add updates.
- QEKF Implementation (Feb. 15th):
  - Add Vicon data as ground truth - done
  - Collect Vicon data (Feb. 15th)
  - Test on multiple datasets
- QEKF/QuEst+VEst Implementation (Feb. 28th):
  - Implement QuEst 5-point (Feb. 15th)
  - Implement VEst (Feb. 15th)
  - 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 (ongoing)
    - Define DLO classes and specs

        * Purchase DLO samples for data collection
    - 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:

- Dead Reckoning (Feb. 2nd, 2022): Dr. Gans, Asif, Reza, and I met and went over the data, and concluded the IMU data is questionable and we should move on from Dead Reckoning project for now.
- VPQEKF (April 1st, 2022): I talked to Dr. Gans about starting on the paper and me said the is no need. He will send me the tex files and I need to make update to VEst section and add a new section for making [1] and [2] work together. Currently, I am reading [1] and [2], and I have received the Matlab implementations from Dr. Gans.
- DLO Manipulation: Dr. Gans forwarded my email to one of his former students and we had a short exchange. He said he will let us know if he hears anything about formboard. I watched IROS conference call for 2021 competition and next I will watch the workshop videos on grasping.
- NBV-Grasping Project: No update.
- PyTorch Tutorials: Transfer learning.
- Pose Estimation: I will need it for DLO segment localization.

4 Intermediate Goals - Fall 2021:

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

References

[1] K. Fathian, J. P. Ramirez-Paredes, E. A. Doucette, J. W. Curtis, and N. R. Gans, "Quest: A quaternion-based approach for camera motion estimation from minimal feature points," *IEEE Robotics and Automation Letters*, vol. 3, no. 2, pp. 857–864, 2018.

[2] Y. Zhang, K. Fathian, and N. R. Gans, "Vest: An efficient solution to the camera velocity estimation from minimal feature points," in *2020 American Control Conference (ACC)*, pp. 3381–3386, IEEE, 2020.