Progress Report

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1 Specific Research Goals

- VPQEKF (IROS - Mar. 1st): Work on the paper.
- DLO Manipulation Proposal: Work on a personal statement.

2 To Do

- Fellowship - DLO:
  - Unity dataset
  - Real dataset
  - Develop a well-written personal statement. — On-going.
  - Seek other graduate fellowship opportunities. — On-going.
  - Develop multiple versions of research and personal statements for submission to different opportunities.
- PVQEKF (Paper deadline March 1st.):
  - Setup ROS environment – (1) – due 12/7
  - Restore github access
  - Replace EKF with QEKF – (2) – due 12/7
  - Feature point extraction:
  - Depth to scale
  - BigC (where we solve Q+V together) –¿ regarding depth scale issue
  - Quat: switching problem is fixed
  - 35 solutions (start here)
  - Noise issue: noise cannot be modelled
  - Chaining step: when feature points come in and out of the frame dependency configuration.

3 Progress

The following items are listed in the order of priority:

- Fellowship: No update.
- VPQEKF: I received a new dataset from Asif with acceleration features. I will have to write new data handler, update the dynamic model and QEKF materices. I will most likely have it done by next Thursday. Regarding implementation of QuEst and Vest [1], it would be more convenient and faster if I rewrite the original Matlab implementation in Python. The current QEKF implementation is in Python as well.
- DLO: I wrote the initial draft for *Stable Control of Double Inverted Pendulum via Feedback Linearization* paper. I derived the *Equations of Motion* for the mentioned system and simulated it in Python. In order to prove the controller is *Optimal*, I will have to derive the *Lyapunov Control Function*, use *Robust Control* formulation, and show it is *stable in finite time*. I will probably not have the time to derive the *Optimal Solution Proof* in full by end of the semester. Dr. Gans and I discussed the possibility of extending this work with addition of novel contributions and publishing it in a control systems conference. To finish the assignment, I will develop multiple test scenarios, run the experiment and discuss the results. Moreover, there will be a section dedicated to studying the *Chaos Within* and show how quickly it appears in experiments.
- 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.
- Active Learning.
- 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.