Progress Report

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Robotic Vision Lab

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1 Specific Research Goals

- Grant Proposal: Controls-Deep Learning Hybrid Systems for Industrial Cable Harnessing Applications. Focus on this for September (hard deadline).
- VPQEKF (IROS - Mar. 1st): Work on the paper, focus on this in October.
- NBV-Grasping (IROS - Mar. 1st): Work on tasks assigned by Chris, one day a week. Focus on this from November till March.

2 To Do

- Grant Proposal: Find three scientific questions to be researched.
- PVQEKF:
  - Go over code and write matrix equations.
  - I will go over the paper once every morning and expand sections for 30 minutes to an hour.
  - Double-check my data prep implementation. Use KITTI Python module.
  - Test with Hilti dataset.
  - Add L2-norm and L2 loss features.
  - I need to separate the state observation and control input vectors from the
  - Develop object tracking and robust-to-truncation feature.
  - Get ROS environment up and running. I need to install Armadillo (C++) with a certain dependency configuration.
- Real-time pose estimation demo.
- NBV-Grasping:
  - Update URDF and Xacro files for UR5e to include a sensor, sensor mount (with offset), and the gripper. – Next
  - Add movement constraints for tables and scenes.

- Write two IK functions for gripper and sensor, one for each. It should plug-in with MoveIt configurator.
- Research and implement point-cloud data to training TensorFlow models.
- Learn and implement GraspIt package.

3 Progress

The following items are listed in the order of priority:

- Fellowship: I updated the execution plan and made sure it contains the correct fellowship requirements. This weekend, I will remove personal material and make it available to other students in a separate repository. Perhaps, it would be forked to the lab repository.
  Moreover, I spent most of my time this week reading about the nature of the problem with wiring harness manufacturing. The issue seems to be a matter of manufacturing agility and increased labor costs rather than a scientific one. Dr. Gans recommended I read more into the scientific aspect of it and come up with three questions or problems to be researched for the proposal.
  Dr. Gans recommended I work on data-driven approaches. I started writing my research statement and have enough for the background paragraph. I added other notes from papers I have read so far. I will be focusing on research problem questions this week as I am still working on [1], [2] and [3].
- VPQEKF: I added some background material and fixed some of the errors. I haven't done much with Hilti dataset after downloading it.
- NBV Grasping Project: No updates.
- PyTorch Tutorials: Transfer learning.
- Pose Estimation: On pause.
- SD Team: No update.
- EE Autonobots: No update.

4 Intermediate Goals - Fall 2021:

- QEKF: Finish paper.
- Active Learning.
- ARIAC: Once I am up to speed, I will do the ARIAC workshops/tutorials and will talk to Jerry about possible contributions.

References

[1] H. G. Nguyen, M. Kuhn, and J. Franke, "Manufacturing automation for automotive wiring harnesses," *Procedia CIRP*, vol. 97, pp. 379–384, 2021.

[2] A. Sintov, S. Macenski, A. Borum, and T. Bretl, "Motion planning for dual-arm manipulation of elastic rods," *IEEE Robotics and Automation Letters*, vol. 5, no. 4, pp. 6065–6072, 2020.

[3] T. Bretl and Z. McCarthy, "Quasi-static manipulation of a kirchhoff elastic rod based on a geometric analysis of equilibrium configurations," *The International Journal of Robotics Research*, vol. 33, no. 1, pp. 48–68, 2014.