Progress Report

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1 Specific Research Goals

- Grant Proposal (Oct 14th): Keep working on this.
- 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. - Done
- Grant Proposal: Finish the first complete draft of the proposal over the weekend.
- Grant Proposal: Next week, start working on the personal statement, use UTA SOP as the initial draft.
- 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 read more papers on deformable object shape and pose estimation, as well as handling and control. Robotics researchers at Google recently published a paper where they introduced DeformableRavens, [1], an open-source simulated benchmark for 1D, 2D and 3D object manipulation. Although Google's publication is both notable and insufficient, it is worth discussing another paper, [2]. The authors present an empirical data set for a dual-arm surgical suturing application using the Da Vinchi robot. I need to read the paper more in the detail, I am interested in their method and approach. I plan on keeping the proposal focused on deformable linear objects (1D) as well as 1) to develop an empirical data-set for shape deformity estimation, 2) to develop an empirical data-set for object state dynamic estimation through *a series of well defined dynamic tests* in dual-arm configuration, 3) to investigate the best methods for learning latent space representation with loss functions that penalize for shape deformity and dynamics estimation errors.
- VPQEKF: No update. 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] D. Seita, P. Florence, J. Tompson, E. Coumans, V. Sindhwani, K. Goldberg, and A. Zeng, "Learning to rearrange deformable cables, fabrics, and bags with goal-conditioned transporter networks," *arXiv preprint arXiv:2012.03385*, 2020.

[2] H. Hashempour, K. Nazari, F. Zhong, *et al.*, "A data-set of piercing needle through deformable objects for deep learning from demonstrations," *arXiv preprint arXiv:2012.02458*, 2020.