

Progress Report

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August 20, 2021

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1 Specific Research Goals

- VPQEKF (ICRA - Sep. 14th) – Probably won't finish till IROS 2022 deadline.
- AFRL Proposal:
- Fellowship.
- NBV-Grasping (IROS - Mar. 1st)
- Universal pose estimation or a novel and superior approach.

2 To Do

- Catch up on my reading list.
- PVQEKF:
 - Keep improving and debugging the QEKF code.
 - Develop object tracking and robust-to-truncation feature.
 - Get ROS environment up and running. – Next: I worked on this for some time. It seems in need to install Armadillo (C++) with certain dependency configuration.
- AFRL: Controls and DNN research.
- Real-time pose estimation demo.
- NBV-Grasping:
 - Update URDF and Xacro files for UR5e to include 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 Reading List

- Leveraging feature uncertainty in the pnp problem [1].
- Normalized objects [2].
- NASA papers [3].

4 Progress

The following items are listed in the order of priority:

- VPQEKf: This week, Asif and I work on the code and made significant improvements. The estimation is still erroneous but at least it now has the correct attitude and heading. The translation estimations seem to have a scalar error.
- NBV Grasping Project: I installed the cable management system on the UR5e robot and installed relative drivers for L515 sensor. I still need to confirm the installation and publish point cloud data using available ROS wrapper.
- Fellowship: I have a few ideas but need to read more papers. I in the process of picking interesting papers from ICRA 2021. I read the abstracts for the first 25-30 percent of the accepted papers, whose title I found interesting or related to advanced manufacturing and controls-DL topics.
- PyTorch Tutorials: Transfer learning.
- Pose Estimation: On pause.
- SD Team: No update.
- EE Autonobots: No update.

5 Immediate Plans - Summer 2021:

The following items are listed in the order of priority:

- UTARI: Dr. Gans' pose and velocity estimation paper.

- NBV-Grasping:
- Pose estimation: Survey paper.

6 Intermediate Goals - Fall 2021:

- Pose estimation: I must be finished with implementation, perhaps make some improvements, and should be working on a paper for ICRA or CVPR.
- Scene understanding and active learning: After pose estimation, I want to expand my research into scene understanding and active learning in the context of advanced manufacturing.
- ARIAC: Once I am up to speed, I will do the ARIAC workshops/tutorials and will talk to Jerry about possible contributions.

References

- [1] L. Ferraz Colomina, X. Binefa, and F. Moreno-Noguer, “Leveraging feature uncertainty in the pnp problem,” in *Proceedings of the BMVC 2014 British Machine Vision Conference*, pp. 1–13, 2014.
- [2] H. Wang, S. Sridhar, J. Huang, J. Valentin, S. Song, and L. J. Guibas, “Normalized object coordinate space for category-level 6d object pose and size estimation,” in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, June 2019.
- [3] NASA, “Nasa technical reports server (ntrs).” <https://ntrs.nasa.gov/>, 2020. (Accessed on 05/07/2021).