

# Progress Report

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## 1 To Do

- PVNet implementation: Debugging Cuda modules.
- Implement pose estimation: Keypoint uncertainty, understand RANSAC.
- Look into methods of generating uncertainty data.
- Pose Estimation Server: On pause.
- Vision-based robotic grasping from object localization, object pose estimation to grasp estimation for parallel grippers - a review, [1]: Will read after PVNet implementation.

## 2 Reading List

- [2]
- [3]
- [1]

## 3 Progress

The following items are listed in the order of priority:

- Pose Estimation: I am still working on PVNet Cuda modules, the code written in Cuda/C++ style, so I have been reading on that. Based on my understanding, I need to update Cuda and C++ API syntax. I learned about Clang, which is used for compiling and debugging C++ source code. I cloned, built and made the LLVM project, [4], which took longer than I expected. It comes with an extensive test suite [5] containing over thirty two compilation tests and only a few failed which tells me I should be okay. I installed this because it is the recommended tool used with Visual Studio Code for debugging Cuda. CLang provides helpful warning and error messages and seems well documented.
- PVNet [6]:

- YCB Dataset [7]: Start with YCB data and look into Berk Calli's work.
- Normalized Objects [8]:
- Implement features from PoseCNN, DOPE, and BayesOD. - On pause.

## 4 Plans

The following items are listed in the order of priority:

- Pose Estimation in Simulation [9]: Use Nvidia Isaac SDK for in-simulation pose estimation training.
- Look into domain randomization and adaptation techniques.
- Project Alpe with Nolan: On pause for right now.
- UR5e: Finish ROS Industrial tutorials.

## 5 2021 Goals and Target Journals/Conferences

- Submit a paper on pose estimation with uncertainty to ICIRS.
- Get comfortable with TensorFlow and related Python modules.
- Keep writing.

## References

- [1] G. Du, K. Wang, S. Lian, and K. Zhao, “Vision-based robotic grasping from object localization, object pose estimation to grasp estimation for parallel grippers: a review,” *Artificial Intelligence Review*, pp. 1–58, 2020.
- [2] 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.
- [3] K. He, X. Zhang, S. Ren, and J. Sun, “Deep residual learning for image recognition. corr abs/1512.03385 (2015),” 2015.
- [4] “The llvm compiler infrastructure project.” <https://llvm.org/>. (Accessed on 03/12/2021).
- [5] “test-suite guide — llvm 12 documentation.” <https://llvm.org/docs/TestSuiteGuide.html>. (Accessed on 03/12/2021).
- [6] S. Peng, Y. Liu, Q. Huang, X. Zhou, and H. Bao, “Pvnet: Pixel-wise voting network for 6dof pose estimation,” in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pp. 4561–4570, 2019.
- [7] B. Calli, A. Singh, A. Walsman, S. Srinivasa, P. Abbeel, and A. M. Dollar, “The ycb object and model set: Towards common benchmarks for manipulation research,” in *2015 international conference on advanced robotics (ICAR)*, pp. 510–517, IEEE, 2015.
- [8] 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.
- [9] Nvidia, “Nvidia isaac sdk — nvidia developer.” <https://developer.nvidia.com/Isaac-sdk>, 2021. (Accessed on 02/05/2021).