Progress Report

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1 To Do

- Write a literature review for [1] and add it Pose Estimation survey paper.
- Implement and play with PoseCNN and DOPE.
- Generate new data set using UE4.
- Read more papers on pose estimation.
- Look into transfer learning. Read [2].
- Look into domain randomization and adaptation.
- Read [3].
- Learn to use UE4.
- Reconstruct a pose estimation model to familiarize myself and then start modifying it.

2 Progress

Following items are listed in order of priority:

- Pose Estimation: This week, I continued with tutorials on NDDS and [4]. I am currently working the presentation with Jerry. We have three and half pages of written material for the survey and I will add two more literature reviews. There is a section that I go through the details of how it works and most of the citations are there. I think this survey along with the IDE Jerry has developed could amount to a paper. After finals, we will need to add our own results and build more performance analysis tools as mentioned in [1].
- Lie Algebra (no new development): It is a vector space V over a base field F along with bracket operation that satisfies bilinearity, anti-symmetry, and the Jacobian Identity conditions. Considering the fact that robotic vision applications are process heavy, I find it immensely important to be familiar with mathematical tools (such as Dynamic Primitive of Motor Control [5]) that enables us to encode important information into our models, whether it is actuator manipulation or

dynamic scene understanding. [6] provides a good starting point on Lie Algebra. I am putting this new theory lead on pause till after Pose Estimation paper for this semester.

- Chaotic System Identification: I need to investigate this at some point. Dr. Lewis mentioned "the world is not a random system, it is chaotic." Let's talk about this. This is very important. There are examples such patterns all over. In some systems that appear very random and "chaotic" to us, we often find similar and distinct patterns emerging. Examples of this phenomena range from Fibonacci sequence appearing all over nature to similar patterns on the bottom starfish to higher dimensional patterns such as similar cultural attributes among historically strange civilizations. This might provide some answers to questions regarding what we know as "collective intelligence."
- OCRTOC: I successfully setup Unreal Engine 4, [4]. Next, we need to look into Domain Randomization and other techniques for developing a data with diverse features and patterns.
- TensorFlow [7]: I am still working through chapter 2.
- MoreFusion [8]: Still need to write a literature review on this.
- Reading list: [9] and [10].
- Project Alpe with Nolan: On pause for right now.
- Quaternions:
- UR5e: I can work on putting together something presentable with UR5e but that might take some time.
- Fellowship:
- System Identification Presentation:

3 Plans

Following items are listed in order of priority:

- (On pause) Continue with ROS Industrial tutorials and documentation.

- (On pause) Resume Robotic Perception course as soon as possible.
- (On pause) Read Digital Image Processing by Gonzalez and Woods.

References

[1] A. Harakeh, M. Smart, and S. L. Waslander, "Bayesod: A bayesian approach for uncertainty estimation in deep object detectors," in *2020 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 87–93, IEEE, 2020.

[2] J. Tobin, R. Fong, A. Ray, J. Schneider, W. Zaremba, and P. Abbeel, "Domain randomization for transferring deep neural networks from simulation to the real world," in *2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 23–30, IEEE, 2017.

[3] C. Choi and H. I. Christensen, "Rgb-d object tracking: A particle filter approach on gpu," in *2013 IEEE/RSJ International Conference on Intelligent Robots and Systems*, pp. 1084–1091, IEEE, 2013.

[4] M. S. Unreal, "Unreal engine [en línea]."

[5] "Dynamic primitives of motor behavior." `https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3735361/#R88`. (Accessed on 11/20/2020).

[6] "L1_defsandexamples.pdf." `https://www.math.upenn.edu/~brweber/Courses/2012/Math650/Notes/L1_DefsandExamples.pdf`. (Accessed on 11/20/2020).

[7] B. Planche and E. Andres, "Hands-on computer vision with tensorflow 2," 2019.

[8] K. Wada, E. Sucar, S. James, D. Lenton, and A. J. Davison, "Morefusion: Multi-object reasoning for 6d pose estimation from volumetric fusion," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pp. 14540–14549, 2020.

[9] J. Lampinen and A. Vehtari, "Bayesian approach for neural networks—review and case studies," *Neural networks*, vol. 14, no. 3, pp. 257–274, 2001.

[10] R. Li, Z. Liu, and J. Tan, "A survey on 3d hand pose estimation: Cameras, methods, and datasets," *Pattern Recognition*, vol. 93, pp. 251–272, 2019.