

16-848 Reference List for February 9, 2022

We began with the Ferrari and Canny grasp quality metric (wrench space ball).

Ferrari, Carlo, and John Canny. "Planning optimal grasps." In *Robotics and Automation, 1992. Proceedings., 1992 IEEE International Conference on*, pp. 2290-2295. IEEE, 1992.
<https://people.eecs.berkeley.edu/~jfc/papers/92/FCicra92.pdf>

We then looked at the seven quality metrics and results presented in this paper, which carried out a large number of experiments with real three-fingered robot hands.

Rubert, Carlos, Daniel Kappler, Jeannette Bohg, and Antonio Morales. "Predicting grasp success in the real world-A study of quality metrics and human assessment." *Robotics and Autonomous Systems* 121 (2019): 103274.
<https://www.sciencedirect.com/science/article/abs/pii/S0921889019300247>

I used the following paper to explain the grasp matrix G and then to go through the math for taking into account the kinematic structure of a robot hand (in this case the human hand) and a specific set of tasks that the hand is required to accomplish.

Li, Ying, Jiaxin L. Fu, and Nancy S. Pollard. "Data-driven grasp synthesis using shape matching and task-based pruning." *IEEE Transactions on visualization and computer graphics* 13, no. 4 (2007): 732-747.
<https://ieeexplore.ieee.org/abstract/document/4293017>

This paper used a physics simulation to evaluate grasp quality:

Kim, Junggon, Kunihiro Iwamoto, James J. Kuffner, Yasuhiro Ota, and Nancy S. Pollard. "Physically based grasp quality evaluation under pose uncertainty." *IEEE Transactions on Robotics* 29, no. 6 (2013): 1424-1439.
http://www.cs.cmu.edu/afs/cs/Web/People/junggon/publications/2013_IEEE_TRO_evalgrasp.pdf

.. and this one uses a weighted A* algorithm to identify globally optimal grasps of objects from their geometric meshes (using the wrench space ball grasp quality metric):

Hang, Kaiyu, Johannes A. Stork, Nancy S. Pollard, and Danica Kragic. "A Framework for Optimal Grasp Contact Planning." *IEEE Robotics and Automation Letters* 2, no. 2 (2017): 704-711.
<http://www.csc.kth.se/~kaiyuh/pdfs/hang2017a.pdf>

We quickly looked at the video from this work as a contrasting point of view. In this line of research, quality of a grasp is estimated from the image alone, based on large amounts of data gained from experience.

Levine, Sergey, Peter Pastor, Alex Krizhevsky, Julian Ibarz, and Deirdre Quillen. "Learning hand-eye coordination for robotic grasping with deep learning and large-scale data collection." *The International Journal of Robotics Research* 37, no. 4-5 (2018): 421-436.
https://journals.sagepub.com/doi/full/10.1177/0278364917710318?casa_token=SDSRQ32qfM8AAAAA%3AkqNr2-QBXTIZNOr3QIegTAhPvUDLP8pNwH6cv3CQgYbfg4fCQQilzarxe4-znb8flf6UBzLhCxhgfg

<https://kargarisaac.medium.com/paper-review-learning-hand-eye-coordination-for-robotic-grasping-with-large-scale-data-collection-a858d69d83b8>