16662 - Robot Autonomy

Assignment 1

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1) Top Rated Grasp of Champange Bottle

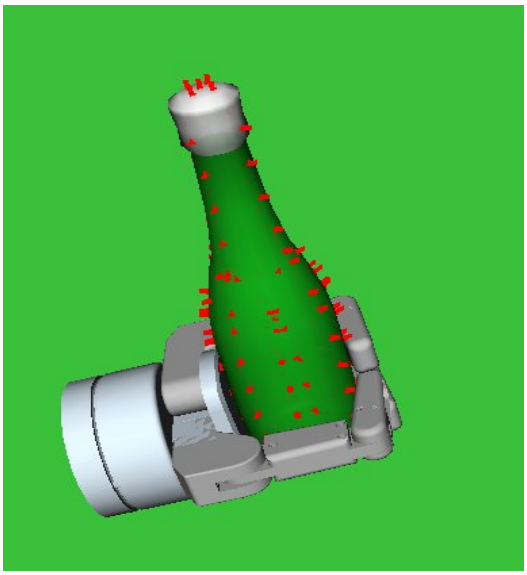

Figure 1.

Intuitively it looks that a human can grab it.Also, if implemented on Herb, it looks like that it will be able to grab the champagne bottle.

2) It took 15 man hours to finish the homework.

3) For the evaluation function, we used weights to measure grasp qualities. Individual scores for each grasps for their isometric, volume and sigma-min, qualities were calculated. These scores were combined for all grasps. All scores were normalized by their respective maximum. In the end we used following equations for all grasps "i" :

$$final_i = A * isometric_{final} + B * volume_{final} + C * \sigma_{final}$$

where:

$$isometric_{final} = isometric_i / isometric_{max}$$
$$volume_{final} = volume_i / volume_{max}$$
$$\sigma_{final} = \sigma_i / \sigma_{max}$$

In our case, we gave weights like: A = 35, B=50 and C=15.

A) Champagne Bottle

Figure 2. Grasp I

Figure 3. Grasp II

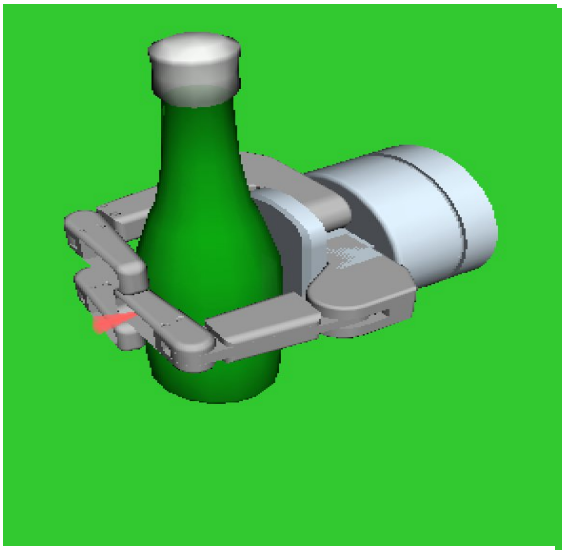

Figure 5. Grasp III

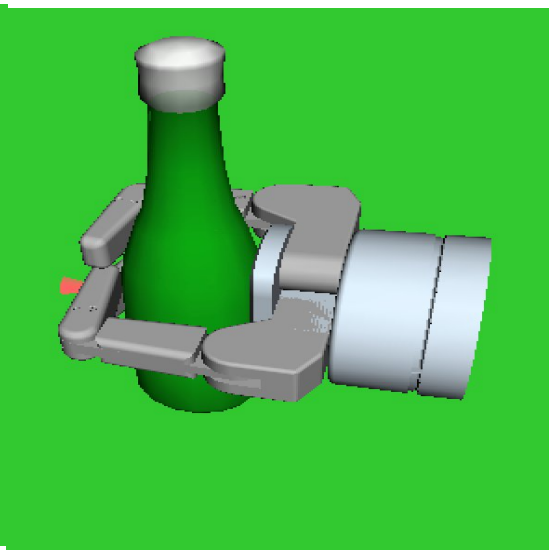

Figure 6. Grasp IV

B) Wine Goblet

Figure 6. Grasp I

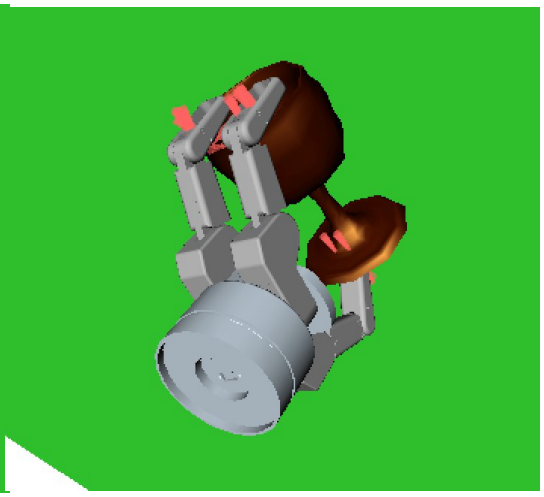

Figure 7. Grasp II

Figure 8. Grasp III

Figure 9. Grasp IV

C) Mug

Figure 10. Grasp I

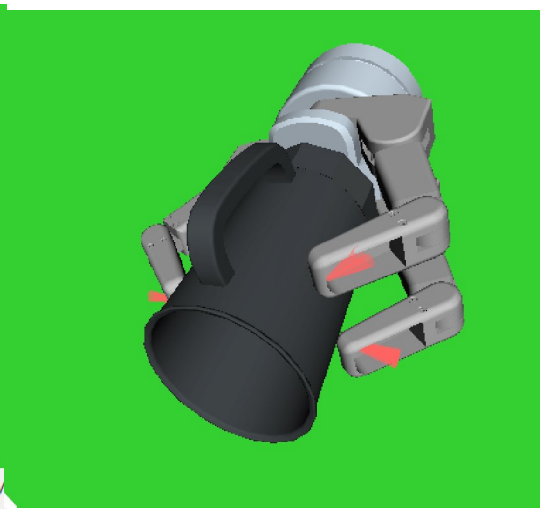

Figure 11. Grasp II

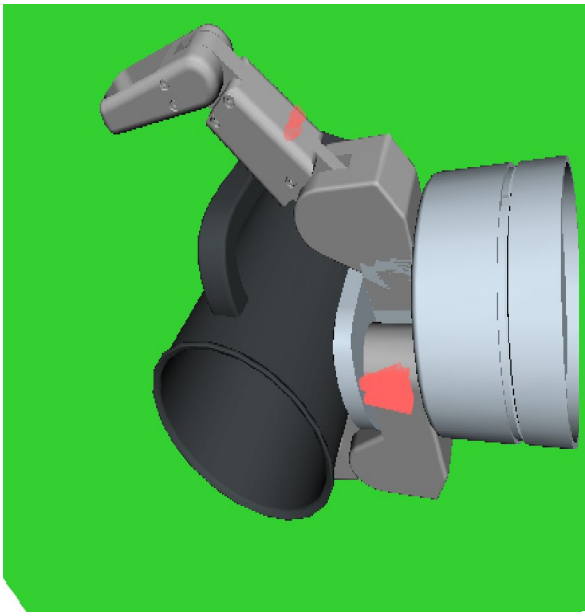

Figure 12. Grasp III

Figure 13. Grasp IV

We used RAND_DIST_SIGMA, RAND_ANGLE_SIGMA and mu = 0 to randomly add noise to the position, direction and roll of a grasp. We used the provided function numpy.normal.random to generate random Gaussian noise. Array of 3 elements were added to position and direction of a grasp while array of 1 element was added to roll of a grasp.We believe that adding noise to our system caused the grasps that had highly robust

approaches to get weighted higher. However, the grasp that would get weighted higher may or may not be a particularly good grasp.

4) Combining random noisy scores.

After adding noise to the grasps, we selected a random grasp from the ordered set that was sorted from previous evaluation. The scores of each of these grasps was calculated in same way by assigning weights. We tweaked the weights for each criteria based on intuition from seeing the results from the previous section.

Once we got the final weights and respective scores for each grasp, we selected scores on the basis that they did not have any NaN values generated from calculating $volume_{final}$..Results were compelling for a few grasps. We couldn't get good grasp with wine goblet. But for mug and champagne, grasps are as follows.

A) Champagne Bottle

Figure 14. Noisy Grasp I

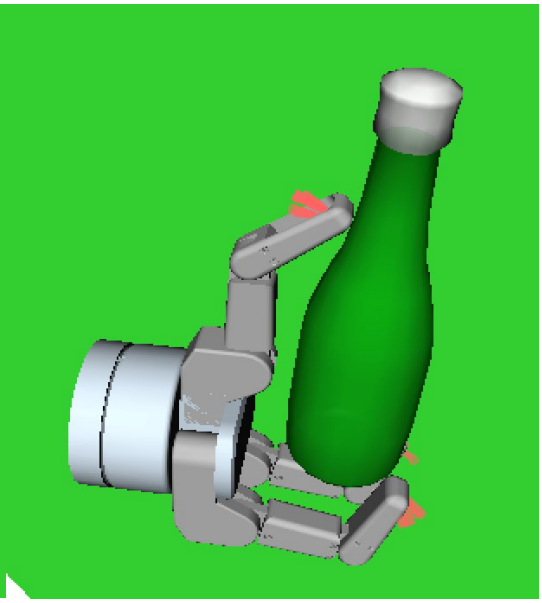

Figure 15. Noisy Grasp II

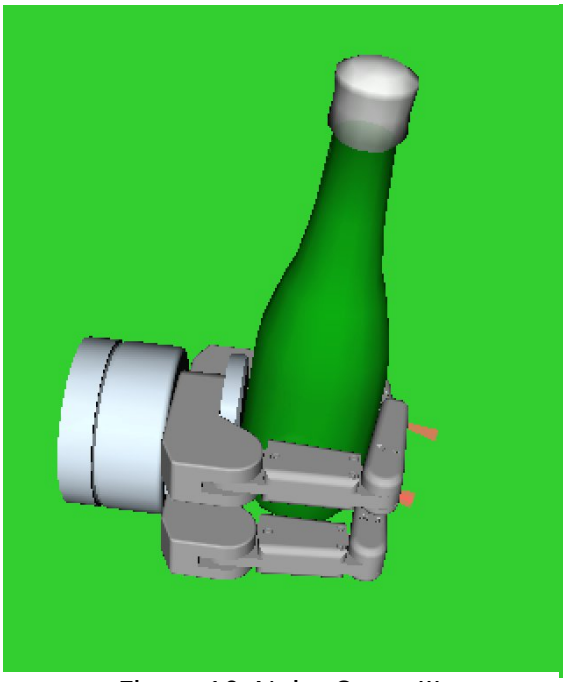

Figure 16. Noisy Grasp III

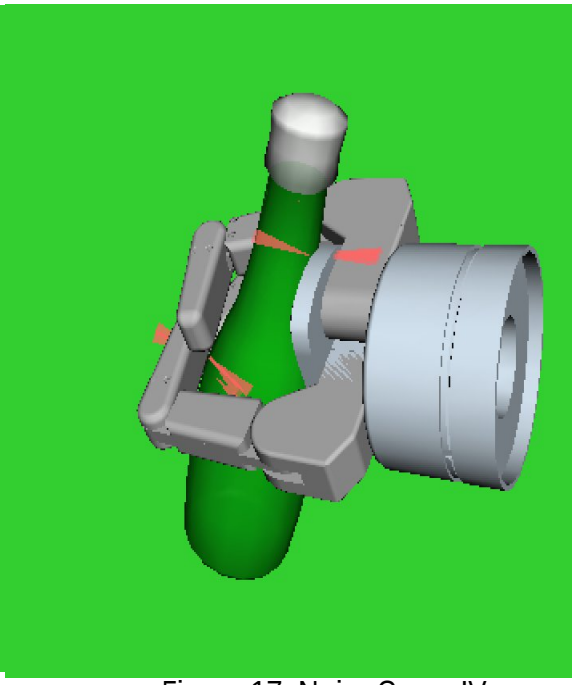

Figure 17. Noisy Grasp IV

B) Wine Goblet

Figure 18. Noisy Grasp I

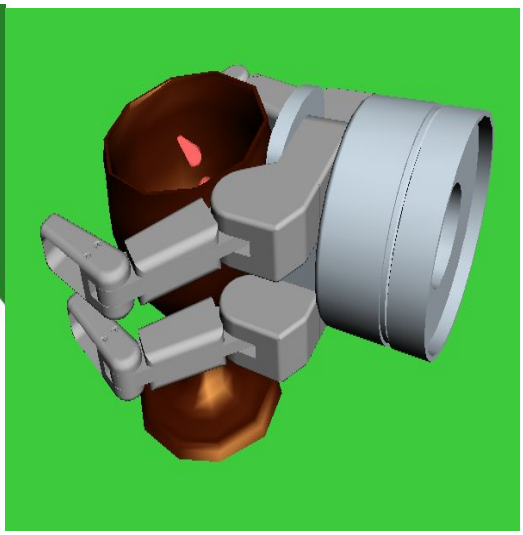

Figure 19. Noisy Grasp II

Figure 20. Noisy Grasp III

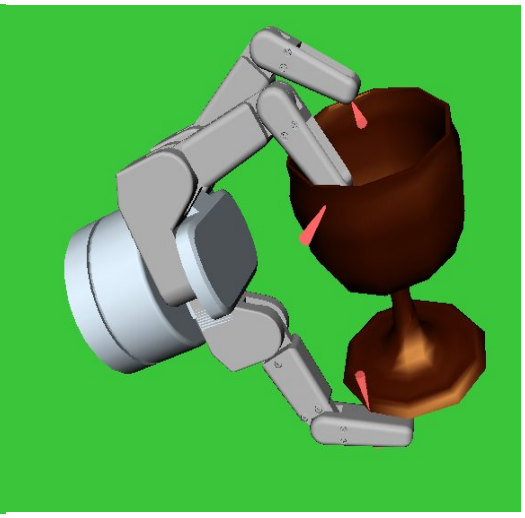

Figure 21. Noisy Grasp IV

C) Mug

Figure 22. Noisy Grasp I

Figure 23. Noisy Grasp II

Figure 24. Noisy Grasp III

Figure 25. Noisy Grasp IV