Practical course robotics
project proposal

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1 Introduction

Robust grasping of unknown and even known objects is a problem at the heart of many tasks in the field of robotics. Often robot perception pipelines suffer from high noise and uncertainty. In this work we leverage the combination of pretrained deep neural networks and a computer vision pipeline to extract robust grasp poses from RGBD-images of real world objects. This perception pipeline is integrated in a robot motion framework to perform the grasps with a robot.

2 Goal

Robot grasping can be subdivided into two related problems: perception and planning. A typical example of this approach is the ROS grasp pipeline [1]. Herein, a CAD model is mapped to a point cloud of the object. Optimal grasp poses are then derived from the CAD model. This works well in ideal scenarios, however, in most realistic applications the scenario is far from ideal. Our main goal is to set up a framework which extracts robust grasp poses from RGBD-Images and grasps an object lying on a table.

3 Problems and methods

This section gives an overview over the general problems of the objective and the methods we will use to overcome these difficulties.

3.1 Localization of objects

needs to be infered if more than one object is in the scene. We will use a SSD for that.

3.2 Localization of robust grasp points

Sampling grasp points from RGBD-Images is a major problem and has been studied by a wide variety of approaches.

3.3 Grasp planning

Reason about how to move the manipulator into the desired grasp pose. The planning component highly relies on the RAI framework for robot manipulation.

- Problems:
  - Localization of objects.
  - Localization of robust grasp points.
- Methods:

	Marc	Ralf
16.05.19	Basic setup, process RGBD images from Baxter/PR2 with GQCNN	Ralfas asdasdasda sdas dasd asdasd as dasd
23.05.19	Grasp object with default grasping policy	
06.06.19	Tune control, recalculate online if object moves	
13.06.19	Experiment with different grasping policies	

- Robot control using *rai* framework
- Sampling of grasp candidates using a grasping policy (e.g. *CrossEntropyRobustGrasping-Policy*[1])
- evaluation of grasp candidates with pretrained *GQCNN*[2]
- localization of objects using bounding boxes (if necessary)

4 Milestones

Requirements

- Baxter
- PR2
- Optional: machine with GPU for further training. We can also bring our own desktop pc.
- Details about camera intrinsics
- RAI framework running on machines with nvidia graphics card (but this problem might be related to the newest nvidia-driver.)

References

[1] S. Chitta, E. G. Jones, M. Ciocarlie, and K. Hsiao. Perception, planning, and execution for mobile manipulation in unstructured environments. *IEEE Robotics and Automation Magazine, Special Issue on Mobile Manipulation*, 19(2):58–71, 2012.

[1] `https://github.com/BerkeleyAutomation/gqcnn/blob/a0930e9d2fef3c930c41dd91cde902d261348fbe/gqcnn/grasping/policy/policy.py#L627`

[2] `https://github.com/BerkeleyAutomation/gqcnn`