Teleoperation of a Robot Arm Using the HTC Vive Virtual Reality Headset

Teleoperation is a useful tool to perform supervised tasks with a robotic platform. Additionally, teleoperation is becoming a popular method for robotic task learning. In these methods, a robot is teleoperated by a human user as a way to demonstrate how a task is to be performed. The robot then uses this experience in combination with modern policy learning techniques to perform the specific task by itself.

The goal of this project is to set-up a teleoperation system with the 7DOF Kuka arm and the VIVE virtual reality kit. Both the arm and VIVE hardware are available in the V4R laboratory. The desired outcome is that a user can generate large quantities of data in order to train modern deep learning approaches for policy learning.

Tasks

- Set up the VIVE kit to work with the Kuka 7DOF arm. This requires both controlling the arm with the provided hand-held joy stick as well as controlling a pan/tilt unit according to the head unit.

- Generate large quantities of data to train an off-the-shelf network for policy learning. For time reasons, this task will focus on a simple action such as grasping an object. If the training works well, the robot should be able to perform the task when shown the same object in a similar configuration.

- Create a parallel simulation set-up where the same Kuka arm can be controlled in an advanced physics simulation environment. The purpose of this is to be able to generate simulated training data that correspond directly with the real data. This would allow a comparison of the network that is trained on real, synthetic and both forms of data. It is interesting to see how suitable synthetic data is for policy learning.

Workload split

- Research and theory: 30%
- Programming and implementation: 20%
- Implementation on a robot platform: 30%
- Writing: 20%

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