Robotics: Assignment IV
(Team Assignment)

Robot Arm Manipulation

Introduction: 11/25-12/06 Demonstration: 11/25-12/16 Submission deadline: 12/16 13:00

So far you have learnt the kinematics of the robot arm and some basic image processing techniques to detect objects from images. In this assignment, you are asked to use this knowledge to write a program that makes the robot arm to pick up blocks. Given three randomly placed blocks, your program should locate these objects through an RGB camera and pick them up one by one. If you want to get a higher grade, try to stack up the blocks, as shown in the right picture.

You have to consider the following issues when doing this homework:

1. The relation between coordinate systems of camera and of robot arm base.
2. The pose of the end-effector is described as (X, Y, Z, A, B, C). (X, Y, Z) is the end-effector position in Cartesian coordinate. However, what do (A, B, C) stand for? Try to manipulate the arm with the software to figure it out.
   (Hint: A, B and C represent a set of Euler angles. Please indicate their rotation axes and order.)
3. You have to do object detection and calculate the centroid and principal angle as in assignment III (b).

A C++ code scratch to connect with the robot arm is provided. To process images, you may also need OpenCV, which is already installed in the computer (2.4.11). You could use other programming languages, but you'll have to handle the connection by yourself.

Should you encounter any technical problems, solve them by discussing with your team members or TAs, and write the solution(s) in your report. TAs will evaluate your work by your demo and report. Be sure to check the safety rules and obey them; any team who violates the rules will get a penalty.

Submission

One team member should upload your source code and a report (hw4_report.pdf) in a zip file to CEIBA. The report should include the program design rationale, problem and solution, as well as work distribution in your team. You have to demonstrate your program to TA before 12/16.

Robot Arm Scheduling

Please book the time on our Google Doc. TA will guide your team to use the robot arm for the first time.
https://docs.google.com/spreadsheets/d/1WBYIJ35CEMCyI_5tKj4NAW8koNyH_XdN4VMP-rvGTmE/edit#gid=0