Robotics and Navigation in Medicine (Project)
Summer term 2023
Robin Mieling robin.mieling@tuhh.de
Carolin Stapper carolin.stapper@tuhh.de

Medical Technology | Intelligent Systems

Instructions for Using the Provided Data

Please download the data from our server.

The directory contains two zipped rosbag files. You can unpack them using for example 7-zip on windows or p7zip on linux. Rosbag is a tool for recording and playing back messages in realtime. You can inspect the content of a rosbag file with the command *rosbag info filename.bag*. You can play it back with *rosbag play filename.bag*. You can visualize the Kinect topics with rviz (Type rviz in a terminal, on the left side click on Add $->$ By topic and visualize the respective topics as an 'Image').

The calibration dataset was recorded with Kinect mounted on the Panda robot. A static checkerboard calibration pattern (40mm square size, 8x5) was placed in the view of the camera. Then, the robot moved to 30 different poses. You can use this dataset to test your implementation for both camera calibration and eye in hand calibration. For the final application you will collect these datasets yourselves with the real robot.

The files regarding the calibration are:

- calibration.bag: a rosbag containing the following topics
  - /k4a/rgb/image_raw: RGB image from the Kinect
  - /k4a/depth/image_raw: Depth image from the Kinect
  - /k4a/ir/image_raw: Infra red image from the Kinect
  - /franka_state_controller/joint_states_desired: the joint positions of the Panda robot
- pose.txt: the 30 4x4 robot poses in row-major. So the first pose is

0.172304	0.27523	0.945807	0.31937
0.732826	-0.677424	0.063632	0.133593
0.658233	0.682152	-0.318412	0.84446
0	0	0	1

- joints.txt: the 30 robot joint configurations; you can use this data to verify your forward kinematics
- trk.txt: the 30 marker poses (checkerboard marker in rgb frame) in the same format as the robot poses
- calibration_results.txt: the factory calibration parameters to check your implementation (uses the 8 parameter rational model for intrinsic calibration)
- hand_eye_results.txt: an example result for the eye-in-hand calibration
- errors.log: Translational and rotational calibration errors after hand_eye calibration.

The second dataset was recorded with the robot driving the camera around the skeleton phantom. You can use this data for stitching the Kinect images to a combined scan and then doing the registration to a high resolution model.

The files regarding the scanning are:

- scanning.bag: A rosbag containing the following topics
  - /k4a/rgb/image_raw: RGB image from the Kinect
  - /k4a/depth/image_raw: Depth image from the Kinect

  - /k4a/points2: pointcloud in the rgb camera reference frame (uses the factory calibration to create the point cloud)
  - /tf: transforms for the robot. You can retreive the end effector pose with tf (documentation, tutorial)
  - /franka_state_controller/joint_states_desired: the joint positions of the robot. You can also use your forward kinematics node to get the robot's end effector pose.
- calibration_results.txt: factory calibration of the Kinect
- handeye_result.txt: corresponding eye-in-hand calibration matrices
- Skeleton_Target.stl: A high resolution scan of the skeleton with an indicated target.