

Mesh Models

The object and robot models are stored as Wavefront `.obj` files in the `models`-folder. The objects correspond to the bottle, `big_luozade`, and the coffee mug, `giraffe_mug`. The mesh-files for different parts of the robot are stored in the `models/robot/kuka_arm_hand`-folder. See below how the proprioceptive signals can be used to reconstruct the robot pose. There is also a textured mesh of the supporting table in the `models/robot/kuka_base_centered`-folder.

Sequences

Kinect color and depth data is provided for two sequences, `camera_motion` and `visual_servoing`. The `visual_servoing` sequence is static from frames 7651 until 8169 and therefore this part of the sequence was not shown in the paper and accompanying videos.

We did not calibrate the Kinect and used the following (default) parameters:

- `focal_length_x` = 525 pixels
- `focal_length_y` = 525 pixels
- `nodal_point_x` = 320 pixels
- `nodal_point_y` = 240 pixels
- `baseline` = 81 mm

Each sequence contains for each frame:

- an image file: `frame_????????.png`
- a Kinect depth file: `kinect_depth_frame_????????.dat.gz`
- a file containing the pose of the robot in world-coordinates obtained from the joint angle measurements: `kinect_robot_pose_frame_????????.txt`

In addition there is also a file `kinect_timestamps.txt` with timestamps for each frame.

The Kinect depth data is stored as a row-major 480x640 matrix containing binary 32-bit float values. It contains disparity rather than depth measurements, as provided by OpenCV's `Openni`-interface with the flag `CAP_OPENNI_DISPARITY_MAP_32F`. This can be transformed to depth using:

$$\text{depth} = (\text{focal_length_x} * \text{baseline}) / \text{disparity}$$

Robot Pose

For each frame, the robot pose is stored in `kinect_robot_pose_frame_????????.txt`, which typically looks as follows:

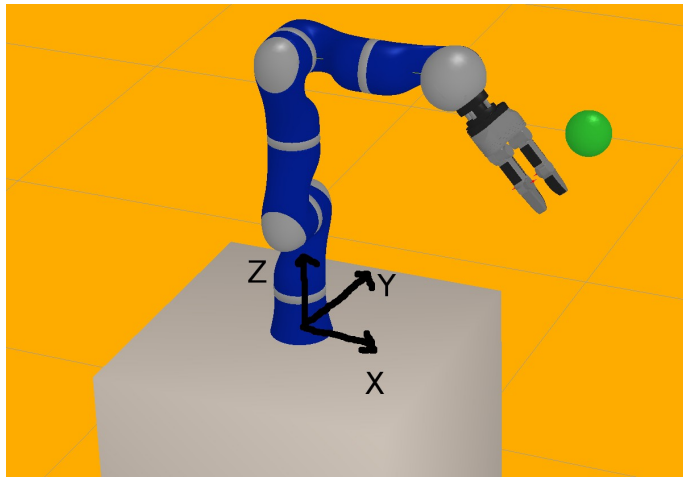
```
ringw1 ringw2 ringw3 ringww1 ringww2 ringww3 ringww4 wristm wristb knk1 knk2 knk3
f1 f1b f2 f2b f3 f3b t1 t1b t2 t2b t3 t3b kuka_base kuka_ring_base table kuka_ring1
kuka_ring2 kuka_ring3 kuka_ring4 kuka_link1 kuka_link1_m kuka_link2 kuka_link2_m
kuka_link3 kuka_link3_m kuka_link4 kuka_link4_m kuka_link5 kuka_wrist bottlecap

-0.0000170630080526 -0.7639531221853507 0.6452717464852359 0.4545301163263029
-0.9999999997871220 0.0000205218233897 -0.0000021468427941 0.0000022697637221
-0.0000116020655637 -0.6452717463845039 -0.7639531223728856 0.6339145711150111
```

```
0.0000000000000000 0.0000000000000000 0.0000000000000000 1.0000000000000000
-0.0000170630080526 -0.7639531221853507 0.6452717464852359 0.4319456051993196
-0.99999999997871220 0.0000205218233897 -0.0000021468427941 0.0000023449032199
-0.0000116020655637 -0.6452717463845039 -0.7639531223728856 0.6606529303980623
0.0000000000000000 0.0000000000000000 0.0000000000000000 1.0000000000000000
```

...

The first line contains the names of the individual robot parts. The pose of each part then follows, and is expressed by a 4x4 transformation matrix stored in row-major order. The pose is with respect to a robot-centered world-coordinate frame (see below).



The mapping between the part names and the mesh-files stored in the `models/robot/kuka_arm_hand-` folder is contained in the `shape_to_mesh_mapping.txt` file. Some of the robot meshes are used multiple times (e.g. the fingers).