## **RoboTwin: Dual-Arm Robot Benchmark with Generative Digital Twins**

## Supplementary Material

#### A. Task Description for RoboTwin

We provide detailed descriptions of all tasks involved in the benchmarks and real-world experiments, as shown in Table 5, totaling 15 tasks. The initial positions of target objects in all tasks are randomized. Some tasks must be completed using both arms, such as *Shoes Place*. Other tasks have both dual-arm and single-arm versions, like *Container Place* and *Empty Cup Place*. For these dual-arm versions, the appropriate arm is selected based on the object's initial position. Tasks like *Block Handover* and *Mug Hanging* involve handoffs between the left and right arms. More challenging tasks, such as *Shoes Place*, require high coordination between both arms.

# **B.** Implementation Details for Simulation Experiments

#### **B.1. Baseline Introduction and Setup**

Diffusion Policy [14] is a novel approach in robot learning that models the robot's visuomotor policy as a conditional denoising diffusion process. It learns the gradient of the action-distribution score function and iteratively optimizes with respect to this gradient field during inference via a series of stochastic Langevin dynamics steps. This methodology enables the robot to generate diverse and highdimensional action distributions, effectively handling multimodal behaviors and high-dimensional action spaces. The input to the Diffusion Policy is a sequence of visual observations, and the output is a sequence of actions predicted over a fixed duration, facilitating robust and temporally consistent action generation.

Building upon the Diffusion Policy, the 3D Diffusion Policy (DP3) [73] integrates 3D visual representations into the diffusion framework, enhancing the robot's ability to generalize across various tasks and environments. DP3 employs a compact 3D visual representation extracted from sparse point clouds using an efficient point encoder. The input to DP3 is a 3D scene representation, and the output is a sequence of 3D end-effector poses, including both translations and rotations, predicted over a fixed duration. This approach allows the robot to perform complex manipulation tasks with high precision and generalization capabilities, even with limited demonstrations.

We outline all the key hyper-parameters for DP [14] and DP3 [73] in Table 6. These hyper-parameters were adopted directly from the original DP and DP3 papers to ensure consistent performance and enable fair comparison with the published results.

For the camera settings, we utilize a 2D observation with an image resolution of (320, 240) and perform FPS downsampling on the point cloud obtained from the image to 1024 points for 3D observation.

### C. Sim2Real Experiment Setup

Our real-world experiments aim to verify whether the generated simulation data can effectively aid in policy learning, enabling high performance in real-world testing despite exposure to only limited real-world data.

#### C.1. Simulation vs. Real Scene Visualization

We present the comparison images of the real and simulation for the same task in Fig. 9. The RoboTwin-generated data demonstrates exceptional visual fidelity to real-world scenarios across all tasks. The simulated environment achieves near photo-realistic quality, accurately capturing lighting, shadows, and object textures. This high-fidelity simulation shows great promise for robot learning by effectively bridging the sim-to-real gap.

#### C.2. Details of Sim2Real Fine-Tuning

To better align real-world and simulation images, and considering that brighter environments facilitate better policy learning and feature extraction, we enhanced the typically darker real-world observations. We applied the following brightness adjustment code, where the alpha parameter can be fine-tuned based on specific lighting conditions:

```
cv2.convertScaleAbs(src, alpha=1.5, beta=0)
```

**Step 1:** We pretrain a Diffusion Policy network using 300 sets of RoboTwin-generated simulation data. This simulation data provides a rich foundation for learning basic manipulation skills. The pretraining phase follows the hyperparameter settings detailed in Tab. 7.

**Step 2:** Following the pretraining phase, we implement a highly efficient fine-tuning approach using only 20 sets of real-world robot data. This minimal data requirement significantly reduces the burden of real-world data collection while still enabling effective domain adaptation. The finetuning process builds upon the pretrained policy network from Step 1, adjusting the network parameters to bridge the sim-to-real gap. All fine-tuning hyperparameters are carefully selected and documented in Tab. 7 to ensure optimal transfer learning performance.

This two-stage training strategy effectively combines the advantages of abundant simulation data with minimal realworld data requirements, demonstrating an efficient approach to robot skill acquisition and transfer.

Number of Demonstrations	20	50	100		20	50	100
Block Hammer Beat				Block Handover			
DP3 (XYZ)	$47.7\pm7.4$	$58.3\pm6.5$	$49.7\pm8.1$	DP3 (XYZ)	$82.7\pm6.1$	$85.0\pm15.6$	$67.3\pm7.0$
DP3 (XYZ+RGB)	$44.7\pm3.8$	$79.0 \pm 2.0$	$77.3 \pm 7.5$	DP3 (XYZ+RGB)	$88.7\pm5.0$	$94.3\pm7.2$	$86.0\pm15.1$
DP	$0.0\pm0.0$	$0.0\pm 0.0$	$0.0\pm0.0$	DP	$0.0\pm 0.0$	$0.0\pm0.0$	$0.7\pm1.2$
Bottle Adjust				Container Place			
DP3 (XYZ)	$55.7\pm1.5$	$70.7\pm2.5$	$72.7\pm10.1$	DP3 (XYZ)	$52.7\pm4.5$	$74.0\pm5.6$	$89.0\pm7.5$
DP3 (XYZ+RGB)	$28.3\pm12.9$	$27.7\pm16.5$	$35.7\pm12.5$	DP3 (XYZ+RGB)	$38.0\pm7.9$	$58.3\pm5.9$	$73.3\pm6.5$
DP	$13.0\pm11.8$	$24.7\pm13.8$	$31.0\pm 6.6$	DP	$5.3\pm4.2$	$16.3\pm2.5$	$35.0\pm4.4$
Empty Cup Place				Mug Hanging (Easy)			
DP3 (XYZ)	$33.0\pm 6.2$	$70.3\pm7.2$	$71.3\pm20.4$	DP3 (XYZ)	$7.3\pm2.9$	$14.0\pm3.6$	$14.7\pm3.5$
DP3 (XYZ+RGB)	$26.3\pm10.4$	$71.3\pm4.0$	$78.7\pm7.4$	DP3 (XYZ+RGB)	$1.0 \pm 1.0$	$2.0 \pm 2.0$	$2.0 \pm 3.5$
DP	$0.3\pm0.6$	$14.7\pm6.0$	$58.0 \pm 11.8$	DP	$0.0\pm 0.0$	$0.0\pm0.0$	$0.0\pm0.0$
Mug Hanging (Hard)				Pick Apple Messy			
DP3 (XYZ)	$12.7\pm0.6$	$11.0\pm6.1$	$12.7\pm2.3$	DP3 (XYZ)	$5.7\pm4.5$	$10.7\pm4.0$	$11.7\pm5.5$
DP3 (XYZ+RGB)	$0.0\pm0.0$	$2.0 \pm 2.0$	$0.3\pm0.6$	DP3 (XYZ+RGB)	$6.7\pm2.3$	$28.7\pm9.5$	$68.7\pm 6.8$
DP	$0.0\pm0.0$	$0.3\pm0.6$	$0.0\pm0.0$	DP	$3.3\pm1.5$	$6.0\pm5.0$	$7.0 \pm 4.6$
Put Apple Cabinet				Dual Bottles Pick (Easy)			
DP3 (XYZ)	$60.7\pm23.0$	$89.3\pm10.8$	$74.7\pm42.2$	DP3 (XYZ)	$37.0\pm4.6$	$60.3 \pm 7.1$	$32.0\pm4.6$
DP3 (XYZ+RGB)	$5.7\pm4.0$	$96.0\pm3.5$	$97.0\pm2.6$	DP3 (XYZ+RGB)	$29.7\pm3.5$	$67.3\pm9.3$	$69.0\pm23.5$
DP	$1.3\pm1.2$	$8.3\pm2.5$	$34.0\pm21.2$	DP	$1.3\pm1.5$	$26.7\pm3.1$	$79.0\pm3.5$
Dual Bottles Pick (Hard)				<b>Diverse Bottles Pick</b>			
DP3 (XYZ)	$33.0\pm2.6$	$48.0\pm5.2$	$57.3\pm4.0$	DP3 (XYZ)	$13.3\pm5.5$	$34.7\pm6.7$	$33.7\pm5.9$
DP3 (XYZ+RGB)	$23.0\pm2.0$	$46.3\pm7.8$	$56.7\pm3.5$	DP3 (XYZ+RGB)	$0.7\pm0.6$	$5.3\pm2.1$	$9.7\pm2.9$
DP	$2.0 \pm 1.7$	$32.3\pm5.9$	$51.7\pm5.1$	DP	$0.0 \pm 0.0$	$0.3\pm0.6$	$6.0 \pm 1.0$
Shoe Place				Dual Shoes Place			
DP3 (XYZ)	$37.0\pm10.5$	$65.7 \pm 11.5$	$54.0\pm10.4$	DP3 (XYZ)	$5.7\pm0.6$	$10.0\pm2.6$	$12.0\pm2.0$
DP3 (XYZ+RGB)	$19.7\pm6.4$	$44.7\pm4.0$	$54.3\pm2.5$	DP3 (XYZ+RGB)	$1.7\pm2.9$	$3.7\pm0.6$	$7.7\pm2.1$
DP	$0.0\pm0.0$	$6.3\pm2.5$	$27.0\pm16.1$	DP	$0.0\pm 0.0$	$3.0 \pm 1.7$	$5.3\pm2.9$

Table 4. Benchmarking imitation learning algorithms for dual-arm manipulation under L515 camera setting. We tested on 14 tasks with 20, 50, and 100 expert demonstrations on DP3 (XYZ), DP3 (XYZ+RGB), and DP, and reported the success rate and standard deviation.



Figure 9. Visualization of real-world and RoboTwin-generated data. For each task, real-world collected data is shown in the top row, with RoboTwin-generated data displayed in the bottom row.

Task	Description
Block Hammer Beat	There is a hammer and a block in the middle of the table. If the block is closer to the left robotic arm, it uses the left arm to pick up the hammer and strike the block; otherwise, it does the opposite.
Block Handover	A long block is placed on the left side of the table. The left arm grasps the upper side of the block and then hands it over to the right arm, which places the block on the blue mat on the right side of the table.
Bottle Adjust	A bottle is placed horizontally on the table. The bottle's design is random and does not repeat in the training and testing sets. When the bottle's head is facing left, pick up the bottle with the right robot arm so that the bottle's head is facing up; otherwise, do the opposite.
Container Place	Random containers (cups, bowls, etc.) are placed randomly on the table. The robotic arm moves the containers into a fixed plate.
Diverse Bottles Pick	A random bottle is placed on the left and right sides of the table. The bottles' designs are random and do not repeat in the training and testing sets. Both left and right arms are used to lift the two bottles to a designated location.
Dual Bottles Pick (Easy)	A red bottle is placed randomly on the left side, and a green bottle is placed ran- domly on the right side of the table. Both bottles are standing upright. The left and right arms are used simultaneously to lift the two bottles to a designated location.
Dual Bottles Pick (Hard)	A red bottle is placed randomly on the left side, and a green bottle is placed ran- domly on the right side of the table. The bottles' postures are random. Both left and right arms are used simultaneously to lift the two bottles to a designated loca- tion.
Dual Shoes Place	One shoe is placed randomly on the left and right sides of the table. The shoes are the same pair with random designs that do not repeat in the training and testing sets. Both left and right arms are used to pick up the shoes and place them in the blue area, with the shoe heads facing the left side of the table.
Empty Cup Place	An empty cup and a cup mat are placed randomly on the left or right side of the table. The robotic arm places the empty cup on the cup mat.
Mug Hanging (Easy)	A mug is placed randomly on the left side of the table, and a mug rack is placed on the right side (fixed). The left arm moves the mug to a suitable position in the middle of the table, and then the right arm hangs the handle of the mug on the mug rack.
Mug Hanging (Hard)	A mug is placed randomly on the left side of the table, and a mug rack is placed randomly on the right side. The left arm moves the mug to a suitable position in the middle of the table, and then the right arm hangs the handle of the mug on the mug rack.
Pick Apple Messy	Apples and four random items are placed randomly on the table. The robotic arm picks up the apple and lifts it.
Put Apple Cabinet	Initially, an apple is placed randomly. The robotic arm uses the left arm to open the cabinet and the right arm to pick up the apple and place them inside.
Shoe Place	Shoes are placed randomly on the table, with random designs that do not repeat in the training and testing sets. The robotic arm moves the shoes to a blue area in the center of the table, with the shoe head facing the left side of the table.

Table 5. Task descriptions for RoboTwin platform.

Parameter	DP [14]	DP3 [73]
horizon	8	8
n_obs_steps	3	3
n_action_steps	6	6
num_inference_steps	100	10
dataloader.batch_size	128	256
dataloader.num_workers	0	8
dataloader.shuffle	True	True
dataloader.pin_memory	True	True
dataloader.persistent_workers	False	False
optimizertarget_	torch.optim.AdamW	torch.optim.AdamW
optimizer.lr	1.0e-4	1.0e-4
optimizer.betas	[0.95, 0.999]	[0.95, 0.999]
optimizer.eps	1.0e-8	1.0e-8
optimizer.weight_decay	1.0e-6	1.0e-6
training.lr_scheduler	cosine	cosine
training.lr_warmup_steps	500	500
training.num_epochs	300	3000
training.gradient_accumulate_every	1	1
training.use_ema	True	True

Table 6. Hyper-parameter Settings for Training and Deployment of DP and DP3 Algorithms.

Parameter	Pre-training	Fine-tuning
horizon	8	8
n_obs_steps	3	3
n_action_steps	6	6
num_inference_steps	100	100
dataloader.batch_size	128	128
dataloader.num_workers	0	0
dataloader.shuffle	True	True
dataloader.pin_memory	True	True
dataloader.persistent_workers	False	False
optimizertarget_	torch.optim.AdamW	torch.optim.AdamW
optimizer.lr	1.0e-4	5e-5
optimizer.betas	[0.95, 0.999]	[0.95, 0.999]
optimizer.eps	1.0e-8	1.0e-8
optimizer.weight_decay	1.0e-6	1.0e-6
training.lr_scheduler	cosine	cosine
training.lr_warmup_steps	500	500
training.num_epochs	300	300
training.gradient_accumulate_every	1	1
training.use_ema	True	True
training.rollout_every	50	50

Table 7. Hyper-parameter Settings for Pretraining with RoboTwin-generated Data and Finetuning with Limited Real-world Data.

#### **D.** Prompts

In the process of generating expert demonstration data, we structure prompts for large language models with three components: 1) Task Information and General Prompt; 2) Introduction to Available APIs, detailing usable programming interfaces and libraries; 3) Function Examples that demonstrate implementation patterns.

#### **D.1. Task Information and General Prompt**

```
You need to generate relevant code for some robot tasks in a robot simulation environment based on the
provided API.
In this environment, distance 1 indicates 1 meter long. Pose is representated as 7 dimention, [x, y, z,
qw, qx, qy, qz]. For a 7-dimensional Pose object, you can use Pose.p to get the [x, y, z] coordinates and
Pose.q to get the [qw, qx, qy, qz] quaternion orientation.
All functions which has parameter actor_data, and all of actor_data should be in the actor_data_dic.
In the world coordinate system, the positive directions of the xyz coordinate axes are right, front, and
upper respectively, so the direction vectors on the right, front, and upper sides are [1,0,0], [0,1,0],
 [0,0,1] respectively. In the same way, we can get the unit vectors of the left side, back side and down
side.
Task Discription:
Use the gripper to pick up block1 and move block 1 to the target position. Then pick up block 2 and place
 it on the block 1, and finally pick up block3 and place it on the block2. If block1's x coordinate (dim
0) is greater than 0, use right arm to stack the block1, else use the left arm. And same for the block2
and block3.
Note:
1. You need to call the get_avoid_collision_pose function to avoid collisions when the left and right
arms move alternately.
2. For example, if the previous action uses the left arm and the next action uses the right arm, you need
to move the left arm after release gripper to avoid collisions, vice versa.
3. The pre-dis of stacked blocks may be smaller.
Available Constants:
self.world_direction_dic: {
                     [0.5, 0.5, 0.5, 0.5],
     'left':
    'front_left':
                    [0.65334811, 0.27043713, 0.65334811, 0.27043713],
    'front': [0.707, 0, 0.707, 0],
'front_right': [0.65334811, -0.27043713, 0.65334811, -0.27043713],
                     [0.5, -0.5, 0.5, 0.5],
    'right':
    'top_down':
                              0, 1,
                                          01,
                    [0,
The world_direction_dic is a dict of different approach directions.
The Actor Name List: ['block1', 'block2', 'block3', 'block1_target_pose']
The Actor Data List: ['block1_data', 'block2_data', 'block3_data', 'block1_target_pose']
The Actor Points Discription: {
    'block1' · f
         'contact_points':[]
        'target_points': ["The top surface center of the block." ],
'functional_points': ["Point0: The center point on the bottom of the block, and functional axis
 is vertical bottom side down"]
         'actor_orientation': []
    'block2':{
        'contact_points':[]
         'target_points': ["The top surface center of the block." ],
        'functional_points': ["Point0: The center point on the bottom of the block, and functional axis
 is vertical bottom side down"]
        'actor_orientation': []
    },
    'block3':{
         'contact_points':[]
        'target_points': ["The top surface center of the block." ],
        'functional_points': ["Point0: The center point on the bottom of the block, and functional axis
is vertical bottom side down"]
        'actor_orientation': []
    }
}
Current Code:
'''python
class gpt_{dual_bottles_pick_hard}({dual_bottles_pick_hard}):
    def play_once(self):
       pass
...
```

#### **D.2. Introduction of Available APIs**

Available API: "open\_left\_gripper": Open the left gripper to a specified position., "close\_left\_gripper": Close the left gripper to a specified position., "open\_right\_gripper": Open the right gripper to a specified position., "close\_right\_gripper": Close the right gripper to a specified position., "together\_open\_gripper": Open both left and right grippers to specified positions., "together\_close\_gripper": Close both left and right grippers to specified positions., "left\_move\_to\_pose\_with\_screw": def left\_move\_to\_pose\_with\_screw(pose). Plan and execute a motion for the left arm using screw motion interpolation. No Return. Args: pose: list [x, y, z, qw, qx, qy, qz], the target pose of left end-effector, "right\_move\_to\_pose\_with\_screw": def right\_move\_to\_pose\_with\_screw(pose). Plan and execute a motion for the right arm using screw motion interpolation. No Return. Args: pose: list [x, y, z, qw, qx, qy, qz], the target pose of right end-effector, "together\_move\_to\_pose\_with\_screw": def together\_move\_to\_pose\_with\_screw(left\_target\_pose, right\_target\_pose). Plan and execute motions for both left and right arms using screw motion interpolation. No Return. Args: left\_target\_pose: list [x, y, z, qw, qx, qy, qz], the target pose of left end-effector right\_target\_pose: list [x, y, z, qw, qx, qy, qz], the target pose of right end-effector, "get\_actor\_functional\_pose": def get\_actor\_functional\_pose(actor, actor\_data), Get the functional pose of the actor in the world coordinate system. Returns: pose: list [x, y, z, qw, qx, qy, qz]. Args: actor: Object(self.actor), the object of actor in render. actor\_data: dict(self.actor\_data), the actor\_data match with actor., "get grasp pose to grasp object": def get\_grasp\_pose\_to\_grasp\_object(self, endpose\_tag: str, actor, actor\_data = DEFAULT\_ACTOR\_DATA,  $pre_dis = 0),$ This function is used to grasp actor from the labeled contact points of the actor, and return the most suitable pose of the end-effector. Returns: pose: list [x, y, z, qw, qx, qy, qz]. Args: endpose\_tag: str, the endpose tag of the actor, can be 'left' or 'right'. actor: Object(self.actor), the object of actor in render. actor\_data: dict(self.actor\_data), the actor\_data match with actor. pre\_dis: float, the distance between grasp pose and target actor pose., "get\_grasp\_pose\_from\_goal\_point\_and\_direction": def get\_grasp\_pose\_from\_goal\_point\_and\_direction(self, actor, actor\_data, endpose\_tag: str, actor\_functional\_point\_id, target\_point, target\_approach\_direction, actor\_target\_orientation = None, pre\_dis): This function is used to move the actor's point of action to the target point when the direction of the end-effector is given, return the pose of the end-effector. The actor refers to an object being grasped by robotic grippers. actor\_target\_orientation is the orientation of the actor after grasping. Returns: pose: list [x, y, z, qw, qx, qy, qz]. Args: actor: Object(self.actor), the object of actor in render. actor\_data: dict(self.actor\_data), the actor\_data match with actor. endpose\_tag: str, the endpose tag of the actor, can be 'left' or 'right'. actor\_functional\_point\_id: int, the index of the functional point of the actor. target\_point: list [x, y, z], the target point pose which the actor's target\_pose expected to move to.  $\texttt{target\_approach\_direction: list [qw, qx, qy, qz], the approach direction which the actor's expected$ approach direction at the target point. The target approach direction can use self.world\_direction\_dic['left', 'front\_left', 'front', 'fron\_right', 'right', 'top\_down']. actor\_target\_orientation: list [x, y, z], the orientation of the actor after grasping. The positive directions of the xyz axis are right, front, and up respectively. You can give a direction vector to specify the target direction of the object. like [0, 0, 1] means the actor' orientation is up and [0, 1, 0] means the actor's orientation is front. pre\_dis: float, the distance on approach direction between actor's point of action and target point., "get\_avoid\_collision\_pose": def get\_avoid\_collision\_pose(self, avoid\_collision\_arm\_tag: str),

```
This function can obtain the safe position of the specified robot arm to avoid collision when both
arms need to move at the same time.
Returns: pose: list [x, y, z, qw, qx, qy, qz].
Args:
avoid_collision_arm_tag: str, 'left' or 'right'.,
"get_actor_goal_pose":
def get_actor_goal_pose(self, actor, actor_data, id),
This function is used to get the target pose point of an actor in world axis.
Returns: pose: list [x, y, z].
Args:
actor: Object(self.actor), the object of actor in render.
actor_data: dict(self.actor_data), the actor_data match with actor.
id: int, the id of the actor, if the actor has multiple target points. And default is 0.,
```

#### **D.3. Function Example**

```
Function Example:
    You can retrieve the actor object by the actor's name:
    '''python
    actor = self.actor_name_dic['actor_name']
    You can retrieve the actor_data object by the actor_data's name:
    '''python
    actor_data = self.actor_data_dic['actor_data_name']
    ...
    Here are some APIs and examples of grasping objects:
    If you want to get the gripper pose to grasp the actor, you typically execute the following code:
    '''python
    grasp_pose = self.get_grasp_pose_to_grasp_object(endpose_tag = "left", self.actor, self.actor_data,
    pre_dis = 0.09) # endpose_tag can be "left" or "right"
   If you want to pick up an actor, you can refer to the following sample code: ``python % \mathcal{A} = \mathcal{A} = \mathcal{A} = \mathcal{A}
   pre_grasp_pose = self.get_grasp_pose_to_grasp_object(endpose_tag = "left", self.actor, self.actor_data,
pre_dis = 0.09) # endpose_tag can be "left" or "right"
   target_grasp_pose = self.get_grasp_pose_to_grasp_object(endpose_tag = "left", self.actor,
    self.actor_data, pre_dis = 0) # endpose_tag can be "left" or "right"
    self.left_move_to_pose_with_screw(pre_grasp_pose)
                                                             # left arm move to the pre grasp pose
   self.left_move_to_pose_with_screw(target_grasp_pose)
                                                            # left arm move to the grasp pose
    self.close_left_gripper()
                                                              # close left gripper to grasp the actor
                                                              # lift the actor up
    self.left_move_to_pose_with_screw(pre_grasp_pose)
    The code for grasping with the right arm or both arms is similar to the above code.
    For the grasping of a certain actor, the movement of the end-effector typically executes the following
    codes:
    ''python
    actor_pose = self.get_actor_goal_pose(self.actor, self.actor_data)
   if actor_pose[0] > 0:
                                     # if the actor in the right side, use right arm to grasp the actor
       # grasp actor with right arm
    else:
                                     # if the actor in the left side, use left arm to grasp the actor
    # grasp actor with left arm
...
    Here are some examples of gripper control:
    '''python
    self.close_left_gripper(pos = 0.02)
                                             # Close half of the left gripper
    self.close_left_gripper(pos = -0.01)
                                             # Tighten the left gripper.
    self.open_left_gripper(pos = 0.02)
                                             # Open half of the left gripper
    self.close_right_gripper(pos = 0.02)
                                              # Close half of the right gripper
    self.close_right_gripper(pos = -0.01) # Tighten the right gripper.
    self.open_right_gripper(pos = 0.02)
                                             # Open half of the right gripper
    self.together_close_gripper(left_pos = 0.02,right_pose = 0.02) # Together close half of grippers
    Note:
    For grabbing some objects, you may need to close the clamping jaws tightly to grab them. You can adjust
    this through the 'pos' parameter, like 'pos = -0.01'.
    By default 'pos' is 0, when close gripper.
```

Here are some APIs and examples of moving objects: Note: The drop height of the actor depends on the distance of the actor that was lifted up the previous action. To move an object to the target point, the 'get\_grasp\_pose\_from\_goal\_point\_and\_direction()' is often called first to obtain the target's gripper posture. If you want to move the point of actor which is grasped by the gripper action to the target point, you typically execute the following code:
```python pre\_grasp\_pose = self.get\_grasp\_pose\_from\_goal\_point\_and\_direction(self.actor, self.actor\_data, endpose\_tag = "left", actor\_functional\_point\_id = 0, target\_pose, target\_approach\_direction, pre\_dis = 0.09) target\_grasp\_pose = self.get\_grasp\_pose\_from\_goal\_point\_and\_direction(self.actor, self.actor\_data, endpose\_tag = "left", actor\_functional\_point\_id = 0, target\_pose, target\_approach\_direction, pre\_dis = 0)
self.left\_move\_to\_pose\_with\_screw(pre\_grasp\_pose) # left arm move to the pre grasp pose self.left\_move\_to\_pose\_with\_screw(pre\_grasp\_pose) # left arm move to the pre grasp pose self.left\_move\_to\_pose\_with\_screw(target\_grasp\_pose) # left arm move to the grasp pose self.open\_left\_gripper() # open left gripper to place the target object # You also can move right arm Note: 1. The target\_approach\_direction is the approach direction which the actor's expected approach direction at the target point. 2. actor\_functional\_point\_id is the index of the functional point of the actor, You can choose based on the given function points information. 3. For the parameter target\_approach\_direction, you can use self.world\_direction\_dic['left', 'front\_left', 'front', 'fron\_right', 'right', 'top\_down']. 4. The target pose can be obtained by calling the 'get\_actor\_goal\_pose()' function. If you also have requirements for the target orientation of the object, you can specify the actor\_target\_orientation parameter through the direction vector to determine the final orientation of the object: '''python # the actor target orientation is front, the direction vector is [0,1,0]# The positive directions of the direction vector xyz axis are right, front, and up respectively. pre\_grasp\_pose = self.get\_grasp\_pose\_from\_goal\_point\_and\_direction(self.actor, self.actor\_data, endpose\_tag = "left", actor\_functional\_point\_id = 0, target\_pose, actor\_target\_orientation = [0,1,0], target\_approach\_direction, pre\_dis = 0.09) target\_grasp\_pose = self.get\_grasp\_pose\_from\_goal\_point\_and\_direction(self.actor, self.actor\_data, endpose\_tag = "left", actor\_functional\_point\_id = 0, target\_pose, actor\_target\_orientation = [0,1,0], target\_approach\_direction, pre\_dis = 0) self.left\_move\_to\_pose\_with\_screw(pre\_grasp\_pose) # left arm move to the pre grasp pose self.left\_move\_to\_pose\_with\_screw(target\_grasp\_pose) # left arm move to the grasp pose self.open\_left\_gripper() # open left gripper to place the target object If you need to align the functional axis of the grabbed object with the functional axis of the target object, you can use the following code: ''python target\_actor\_functional\_pose = self.get\_actor\_functional\_pose(self.actor, self.actor\_data, actor\_functional\_point\_id = 0) target\_actor\_point = target\_actor\_functional\_pose[:3] target\_approach\_direction = target\_actor\_functional\_pose[3:] pre\_grasp\_pose = self.get\_grasp\_pose\_from\_goal\_point\_and\_direction(self.actor, self.actor\_data, endpose\_tag = "left", actor\_functional\_point\_id = 0, target\_point = target\_actor\_point, target\_approach\_direction = target\_approach\_direction, pre\_dis = 0.09) target\_grasp\_pose = self.get\_grasp\_pose\_from\_goal\_point\_and\_direction(self.actor, self.actor\_data, endpose\_tag = "left", actor\_functional\_point\_id = 0, target\_point = target\_actor\_point, target\_approach\_direction = target\_approach\_direction, pre\_dis = 0) # left arm move to the pre grasp pose
# left arm move to the grasp pose self.left\_move\_to\_pose\_with\_screw(pre\_grasp\_pose) self.left\_move\_to\_pose\_with\_screw(target\_grasp\_pose) self.open\_left\_gripper() # open left gripper to place the target object
} Note: 1. The parameter actor in get\_grasp\_pose\_from\_goal\_point\_and\_direction() should be grasp actor, not the target actor. 2. self.world\_direction\_dic is a dict of different approach directions. 3. This situation usually occurs when hanging objects or performing some delicate operations. 4. actor\_functional\_point\_id is the index of the functional point of the actor, You can choose based on the given function points information. Some tasks involve simultaneous operations of the left and right arms, which may require calling the collision avoidance function: 1. There is no need to avoid collision at the end of the task. If both arms have moved at the same time before, and the next step needs to be to move the left arm 2. first to place the target object, You can first obtain the pose of the right arm that can avoid subsequent collisions, and then move both arms at the same time:

| " "python                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| # Get Left and right arm target pose<br># Ware the direction in which the object contacts the target point is vertically top down as an example                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| # The actor target orientation is left, the direction vector is [-1,0,0].                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| left_pre_pose = self.get_grasp_pose_from_goal_point_and_direction(left_actor, left_actor_data,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <pre>endpose_tag="left", actor_functional_point_id = 0, target_point=point1,</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <pre>target_approach_direction=self.world_direction_dic['top_down'], actor_target_orientation=[-1, 0, 0],</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| pre_dis=0.05)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <pre>left_target_pose = self.get_grasp_pose_irom_goal_point_and_direction(left_actor, left_actor_data,<br/>endpage target[left]</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| endpose_cag="left", actor_innctional_point_id = 0, target_point=point;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| pre dis=0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| right_pre_pose = self.get_grasp_pose_from_goal_point_and_direction(right_actor, right_actor_data,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| endpose_tag="right", actor_functional_point_id = 0, target_point=point2,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <pre>target_approach_direction=self.world_direction_dic['top_down'], actor_target_orientation=[-1, 0, 0],</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| $p_{IE}$ (15-0.05) right page = self get grasp pose from goal point and direction(right actor, right actor data.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| endose tag="right", actor functional point d = 0, target point=point2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <pre>target_approach_direction=self.world_direction_dic['top_down'], actor_target_orientation=[-1, 0, 0],</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| pre_dis=0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| # right arm avoid collision pose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| right_avoid_collision_pose = self.get_avoid_collision_pose(avoid_collision_arm_tag = 'right')                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| # move left arm to the pre pose and right arm to the avoid collision pose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <pre>self.together_move_to_pose_with_screw(left_pre_pose, right_avoid_collision_pose) # nut_down_the_seter_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_relation_rela</pre> |
| * put down the actor on left gripper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| self.open left gripper() # open left gripper to place the target object                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| # left arm avoid collision pose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| left_avoid_collision_pose = self.get_avoid_collision_pose(avoid_collision_arm_tag = 'left')                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| # move right arm to the target pose and left arm to the avoid collision pose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| self.together_move_to_pose_with_screw(left_avoid_collision_pose, right_pre_pose)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| # put down the actor on right gripper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| self.right_move_to_pose_with_screw(right_target_pose)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| seri-open_ingnt_gripper() * open fight gripper to place the target object                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| # direction: /left/. /right/. /front/. /back/. /up/. /down/                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Note:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 1. If the move_arm_tag is 'left', the direction also not be 'right', and same for 'right'.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2. Collision avoidance may only be necessary if both arms have been moved.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

#### D.4. Sample Code for Blocks Stack Hard Task

```
class gpt_blocks_stack_hard(blocks_stack_hard):
     def play_once(self):
          # Retrieve actor objects
         block1 = self.actor_name_dic['block1']
block2 = self.actor_name_dic['block2']
block2 = colf actor_name_dic['block2']
         block3 = self.actor_name_dic['block3']
         block1_target_pose = self.actor_name_dic['block1_target_pose']
          # Retrieve actor data objects
         blockl_data = self.actor_data_dic['blockl_data']
block2_data = self.actor_data_dic['block2_data']
block3_data = self.actor_data_dic['block3_data']
         block1_target_pose_data = self.actor_data_dic['block1_target_pose']
          \ensuremath{\texttt{\#}} Define pre-dis for grasping and placing
         pre_dis = 0.08
          # Function to grasp and place a block
          def grasp_and_place(block, block_data, target_pose, target_pose_data, pre_dis):
               # Determine which arm to use based on the block's x coordinate
              block_pose = self.get_actor_goal_pose(block, block_data)
              if block_pose[0] > 0:
                   arm_tag = "right"
                   move_function = self.right_move_to_pose_with_screw
                   close_gripper_function = self.close_right_gripper
                   open_gripper_function = self.open_right_gripper
               else:
                   arm_tag = "left"
                   move_function = self.left_move_to_pose_with_screw
```

```
close_gripper_function = self.close_left_gripper
open_gripper_function = self.open_left_gripper
           # Get the grasp pose
           pre_grasp_pose = self.get_grasp_pose_to_grasp_object(endpose_tag=arm_tag, actor=block,
actor_data=block_data, pre_dis=pre_dis)
           target_grasp_pose = self.get_grasp_pose_to_grasp_object(endpose_tag=arm_tag, actor=block,
actor_data=block_data, pre_dis=0)
           # Move to the pre-grasp pose
           move_function(pre_grasp_pose)
           # Move to the grasp pose
           move_function(target_grasp_pose)
           # Close the gripper to grasp the block
           close_gripper_function()
           # Lift the block up
           move_function(pre_grasp_pose)
           # Get the target pose for placing the block
           target_point = self.get_actor_goal_pose(target_pose, target_pose_data)
           target_approach_direction = self.world_direction_dic['top_down']
           pre_place_pose = self.get_grasp_pose_from_goal_point_and_direction(block, block_data,
endpose_tag=arm_tag, actor_functional_point_id=0, target_point=target_point,
target_approach_direction=target_approach_direction, pre_dis=pre_dis)
           target_place_pose = self.get_grasp_pose_from_goal_point_and_direction(block, block_data,
endpose_tag=arm_tag, actor_functional_point_id=0, target_point=target_point,
target_approach_direction=target_approach_direction, pre_dis=0)
           # Move to the pre-place pose
           move_function (pre_place_pose)
           # Move to the place pose
           move_function(target_place_pose)
           # Open the gripper to place the block
           open_gripper_function()
           # Lift the arm up
           move_function(pre_place_pose)
       # Grasp and place block1
       grasp_and_place(block1, block1_data, block1_target_pose, block1_target_pose_data, pre_dis)
       # Avoid collision if necessary
       if self.get_actor_goal_pose(block1, block1_data)[0] > 0:
           avoid_collision_pose = self.get_avoid_collision_pose(avoid_collision_arm_tag='left')
           self.left_move_to_pose_with_screw(avoid_collision_pose)
       else:
           avoid_collision_pose = self.get_avoid_collision_pose(avoid_collision_arm_tag='right')
           self.right_move_to_pose_with_screw(avoid_collision_pose)
       # Grasp and place block2 on top of block1
       grasp_and_place(block2, block2_data, block1, block1_data, pre_dis)
       # Avoid collision if necessary
       if self.get_actor_goal_pose(block2, block2_data)[0] > 0:
           avoid_collision_pose = self.get_avoid_collision_pose(avoid_collision_arm_tag='left')
           self.left_move_to_pose_with_screw(avoid_collision_pose)
       else:
           avoid_collision_pose = self.get_avoid_collision_pose(avoid_collision_arm_tag='right')
           self.right_move_to_pose_with_screw(avoid_collision_pose)
       # Grasp and place block3 on top of block2
       grasp_and_place(block3, block3_data, block2, block2_data, pre_dis)
       # Avoid collision if necessary
       if self.get_actor_goal_pose(block3, block3_data)[0] > 0:
           avoid_collision_pose = self.get_avoid_collision_pose(avoid_collision_arm_tag='left')
           self.left_move_to_pose_with_screw(avoid_collision_pose)
       else:
           avoid_collision_pose = self.get_avoid_collision_pose(avoid_collision_arm_tag='right')
           self.right_move_to_pose_with_screw(avoid_collision_pose)
```