Dex-Net 2.1: Learning Deep Policies for Robot Bin Picking by Simulating Robust Grasping Sequences

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Keywork	
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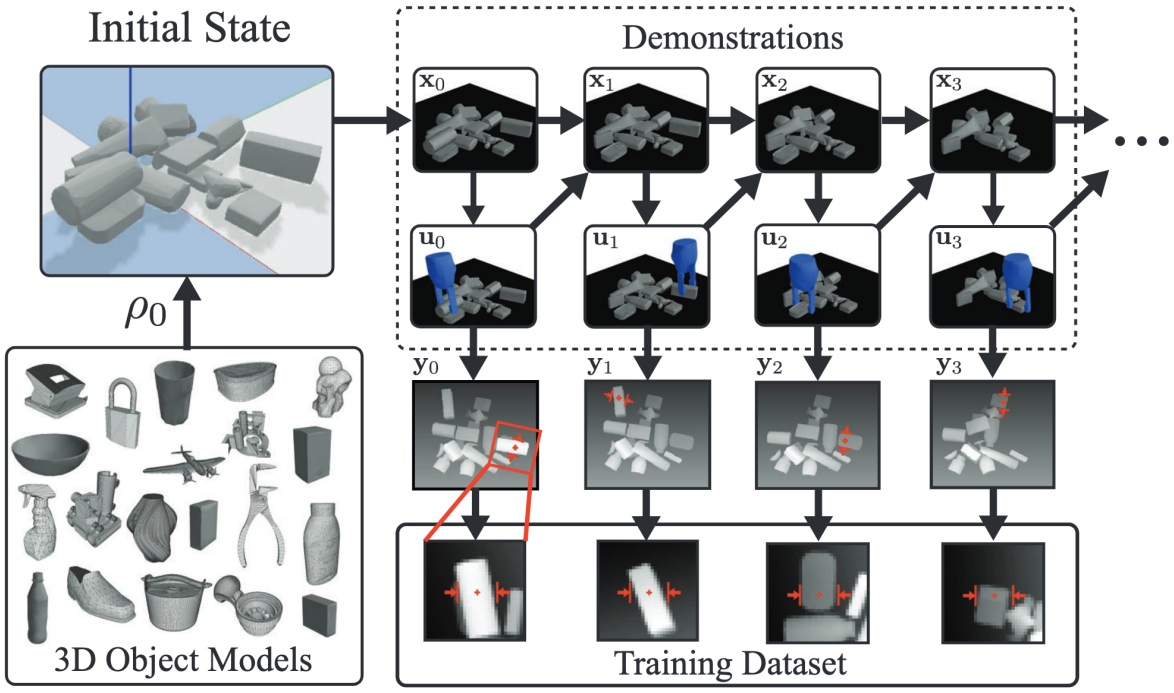

Figure 1: Overview of our POMDP model and simulator. We sample from the initial state distribution0 by uniformly samplingm 3D CAD object models from a dataset and dropping them in random poses in the pybullet dynamic simulator [23] to form a heap. The state xt includes object shapes and poses in the heap. We generate demonstrations of robot grasping using an algorithmic supervisor from Dex-Net 2.0 [3] that indexes the most robust collision-free parallel-jaw grasp ut from a pre-planned grasp database using knowledge of the full state. We aggregate synthetic point cloud observation syt and collected rewards Rt to form a labeled dataset for training a policy that classifies the supversiors actions on the partial observations using imitation learning. We preprocess training data by transforming the point clouds to align the grasp center and axis with the center pixel and middle row to improve GQ-CNN classification performance [2,3].

3.1 Assumptions

Our model assumes quasi-static physics, where inertial effects are negligible, to compute grasp robustness. Our model also assumes a parallel-jaw gripper, rigid objects, a depth sensor with bounds on the camera intrinsic parameters and pose relative to the robot, and bounds on friction across objects and their surfaces.

These assumptions are common in industrial robotics [14]. We make the additional simplifying assumption that only one object is be grasped at a time. Our model also does not consider object identity when grasping.

1. 1次只能抓1個
2. 不考慮辨識物件類別