

Online Robotic Grasping for Moving Objects

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Dynamic Grasping

Pick up a moving object whose motion is not known apriori, while avoiding obstacles

Assumptions from previous work

- Prior knowledge of object motion
- Limited grasping direction
- Waiting for target to come to rest / human signal
- No cluttered scene / obstacles

Can we relax some of these assumptions and do better?

Dynamic Grasping

Pick up a moving object whose motion is not known apriori, while avoiding obstacles

Key components

- Object motion prediction
- Real-time Grasping
- Arm Trajectory Generation

Dynamic Grasping

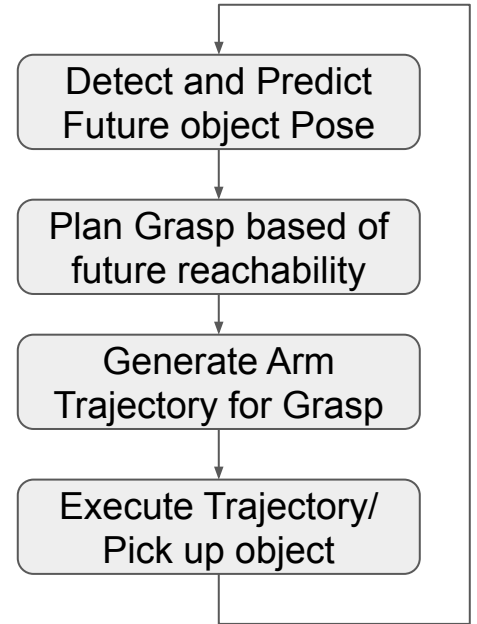
Method

- Object motion prediction:
 - Object Pose Estimation (DOPE/DenseFusion)
 - Kalman Filter
- Real-time Full DOF Grasping:
 - Reachability-aware grasping
 - Key Idea: Reachability is a measure of manipulability
 - Seed grasp planner with grasp from previous timestep
- Arm Trajectory Generation:
 - Jacobian control does not handle obstacles
 - RRT can result in a wavy motion, stomp can be time-consuming
 - Hybrid of cartesian motion plus RRT/Stomp

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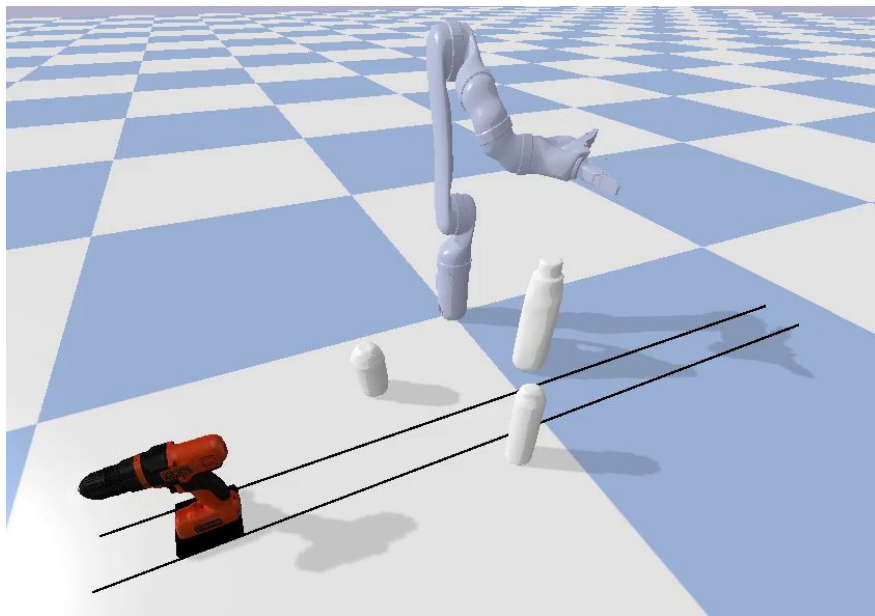
Dynamic Grasping in Simulation

Experimental Setup: Conveyor Belt

- Vary distance to robot
- Vary speed of moving object
- Presence of obstacles

Methods

- Online Grasping + KF
- Online Grasping without KF
- Offline Grasping + KF



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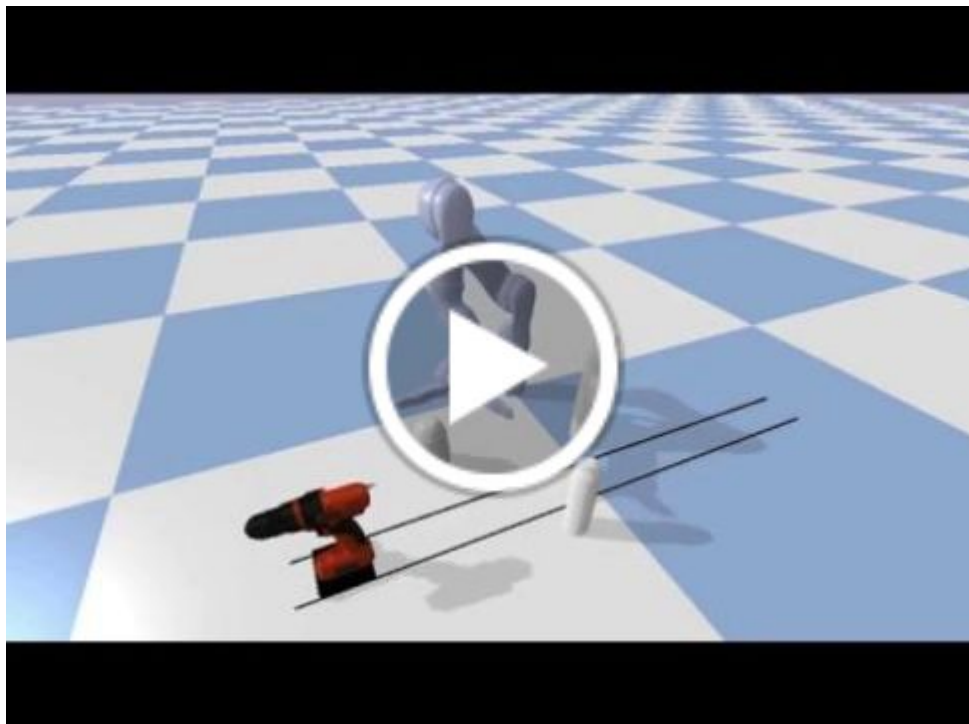
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Dynamic Grasping in Simulation

Preliminary Results and Observations

- Adding Kalman filter does not improve performance at slow speed
- Online grasping helps improve grasping success
- High speed is challenging. Ongoing: Analysis of the limits of each robot arm for dynamic grasping

See you at the Poster Session!

Thank you