A Graph-Based Search Approach to Planning and Learning

G.S. Groote

Supervisors: C. Pezzato
M. Wisse
C. Smith

Delft University of Technology, The Netherlands

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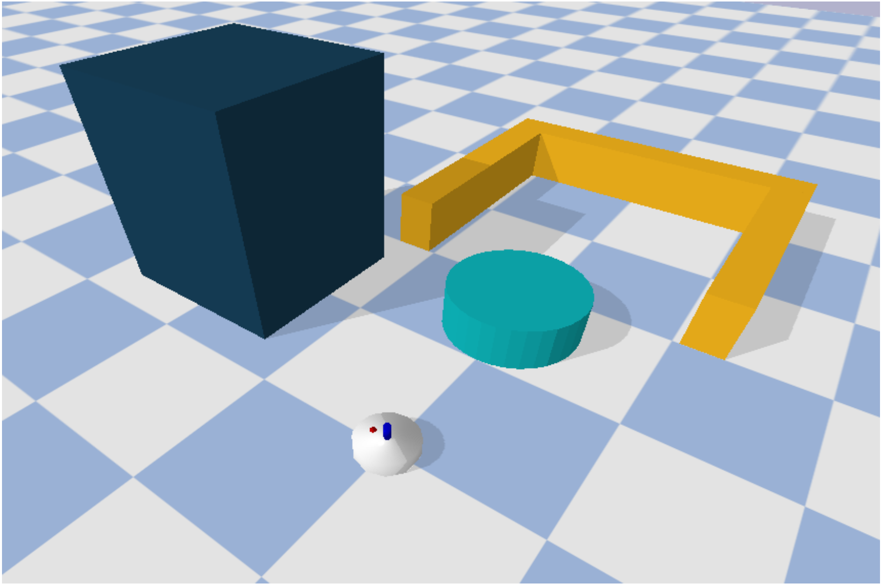
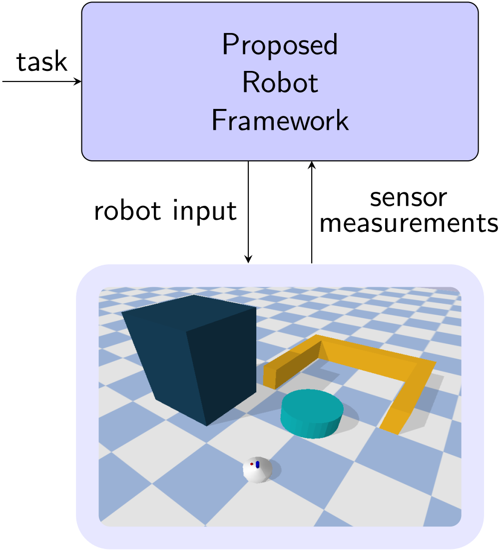
Intro: Robot Environment



Intro: Thesis Goal

- Learning System Models
- Navigation Among Movable Objects (NAMO)
- Nonprehensile Pushing

Intro: Overview Proposed Method



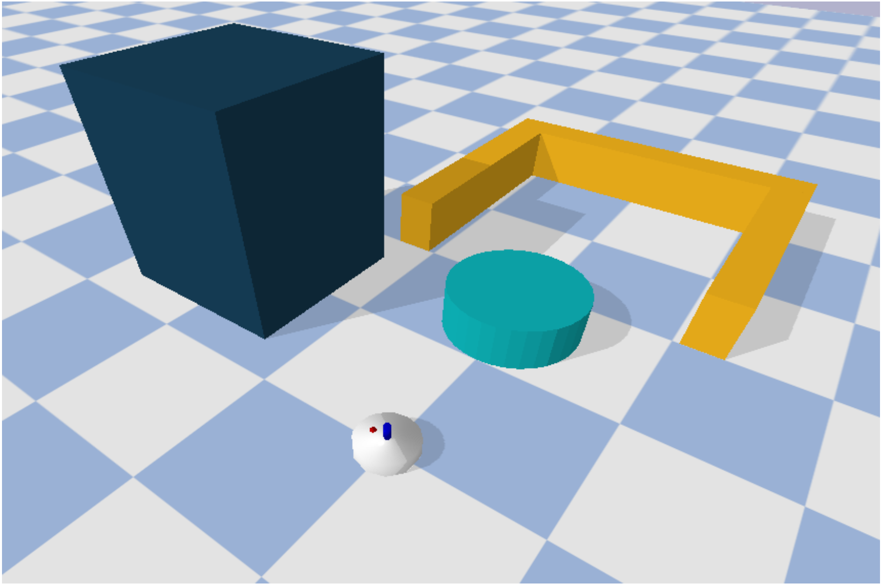
Intro: Research Question

How do learned objects' system models improve global task planning for a robot with nonprehensile push manipulation abilities over time?

Research Subquestions:

1. How to combine learning and planning for push and drive applications?
2. How does the proposed framework compare against the state-of-the-art?

Intro: Task Specification



Intro: Task Specification

Assumptions

1. **Closed-World Assumption:** Objects are manipulated, directly or indirectly only by the robot. Objects cannot be manipulated by influences from outside the environment.
2. **Perfect Object Sensor Assumption:** the robot has full access to the poses and geometry of all objects in the environment at all times.
3. **Tasks are Commutative Assumption:** Tasks consist of multiple objects with specified target positions. The order in which objects are pushed toward their target position is commutative.
4. **Objects do not tip over Assumption:** Movable objects slide if pushed.

State-of-The-Art

		NAMO		Specify object target poses	
Author	Learns object dynamics	prehensile	nonprehesile	prehensile	nonprehesile
Ellis et al.	✓	✗	✓	✗	✗
Sabbagh Novin et al.	✓	✓	✗	✓	✗
Scholz et al.	✓	✓	✗	✗	✗
Vega-Brown and Roy	✗	✓	✗	✓	✗
Wang et al.	✓	✗	✓	✗	✗
Groote	✓	✗	✓	✗	✓