A Graph-Based Search Approach to Planning and Learning

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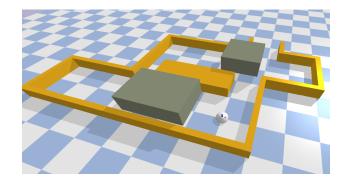
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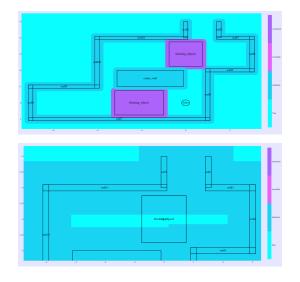
Thesis Goal

- Learning System Models
- Navigation Among Movable Objects
- Nonprehensile Pushing

Robot Environment



Joint Configuration Space



Research Question

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

Research Subquestions:

- Oan the proposed method combine learning and planning for push en drive applications with a technique known as backward search?
- 2 How do learning system models and remembering interactions compare to only learning system models? And, how does the proposed method compare against the state-of-the-art?

State-of-The-Art

Author	Learning	NAMO	Object to Target	Manipulation
Ellis et al. Sabbagh Novin et al.	1	×	×	pushing grasp-push grasp-pull
Scholz et al.	✓	✓	X	graph-push grasp-pull
Vega-Brown et al.	X	✓	✓	gripping
Wang et al. Groote	√ ?	√ ?	x ?	pushing pushing

Robot Environment

make slide



Assumptions

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Task Specification

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Required Background: Path Estimation

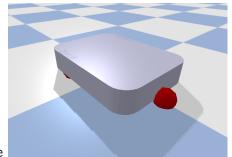
Required Background: Planning

Required Background: System identification

Required Background: Control Methods

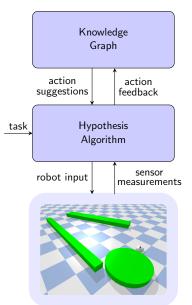
Required Background: Summary

Proposed Method an Overview

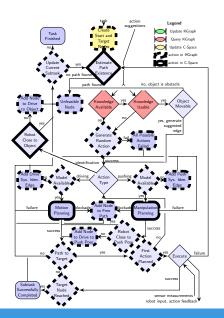


Hypothesis Algorithm

Overview Proposed Method



Hypothesis Algorithm



Hypothesis Graph

make hgraph definition

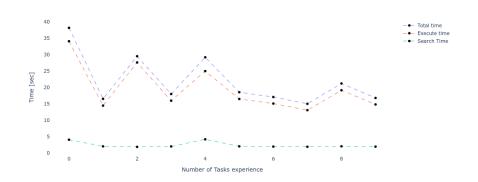
make example hgraph



Knowledge Graph

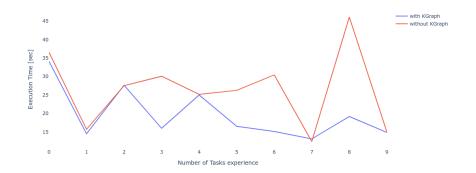
kgraph definition and example

Results: Randomisation Drive Task



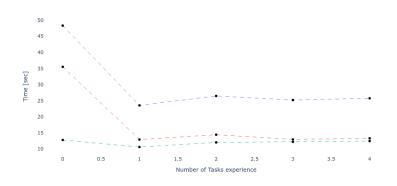


Results: Randomisation Drive Task



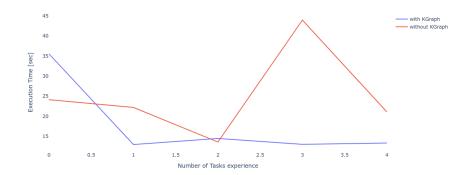


Results: Randomisation Push Task





Results: Randomisation





Results

Author	Learning	NAMO	Object to Target	Manipulation
Ellis et al. Sabbagh Novin et al.	1	×	X ✓	pushing grasp-push grasp-pull
Scholz et al.	✓	✓	×	graph-push grasp-pull
Vega-Brown et al.	X	✓	✓	gripping
Wang et al. Groote	✓ ×/✓	√ ✓	X ✓	pushing pushing