Robotic Collaboration through Scalable Reactive Synthesis

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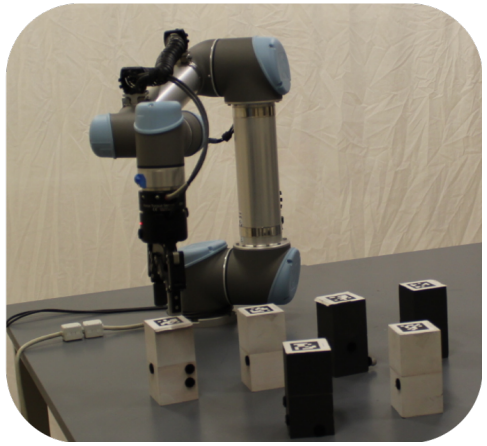
Problem

Given a finite-horizon temporal specification and a model of possible human-robot actions, synthesize a policy to guarantee task completion

Start: Blocks on the table →



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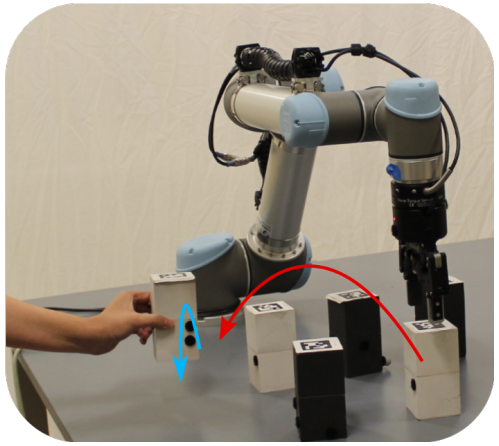
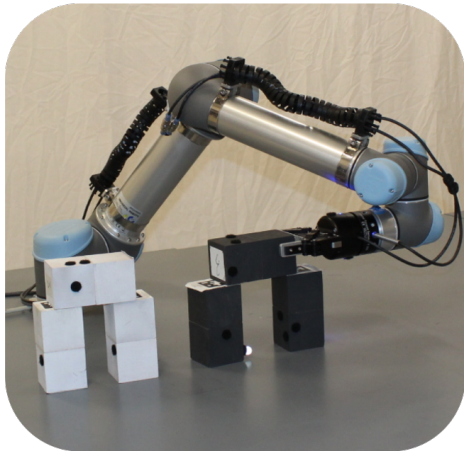


→ Goal



Human moves one block (human action in blue)
Robot puts another block in its place (robot action in red)

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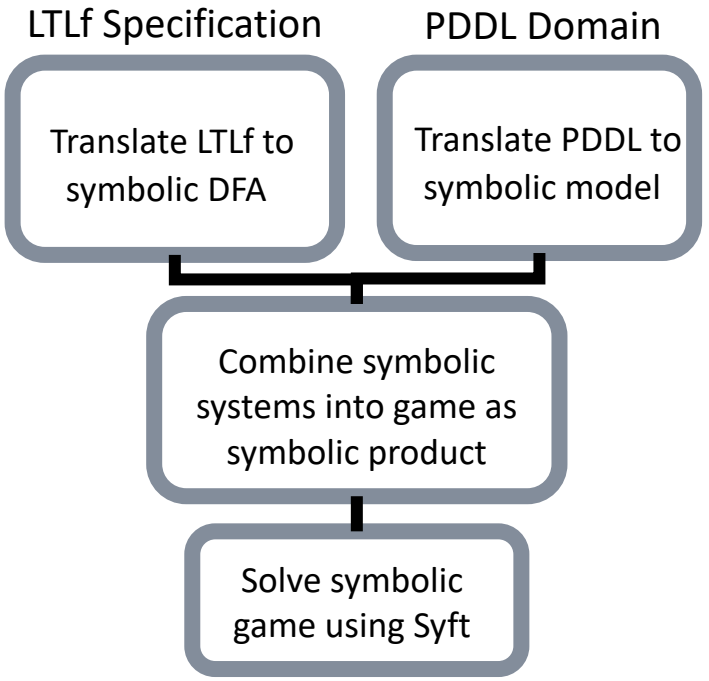
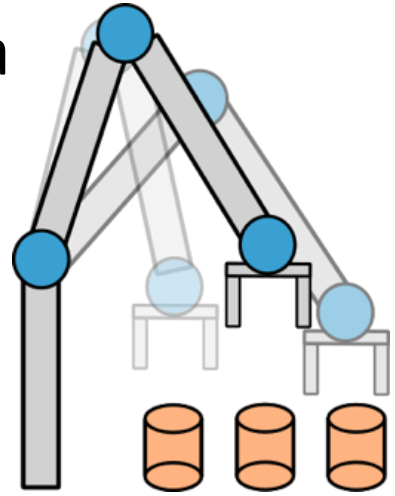
Framework

- Specify Task in finite-trace Linear Temporal Logic (LTLf)
- Model Human-Robot ensemble using augmented PDDL
- Convert LTLf to a Deterministic Finite Automaton
- Translate PDDL model to a symbolic transition system
- Combine DFA with transition system to form a game
- Solve game using existing tools for policy synthesis



Key Idea

Symbolic Synthesis



Scientific Impact

- Formal methods + Robotics
- Role of symbolic encodings
- Models for human-robot interaction

Broader Impact

- Assistive robotics
- Training of students at all levels
- Undergraduate outreach