

NRI: FND: Knowledge-based Robot Sequential Decision Making under Uncertainty (NSF NRI #1925044)

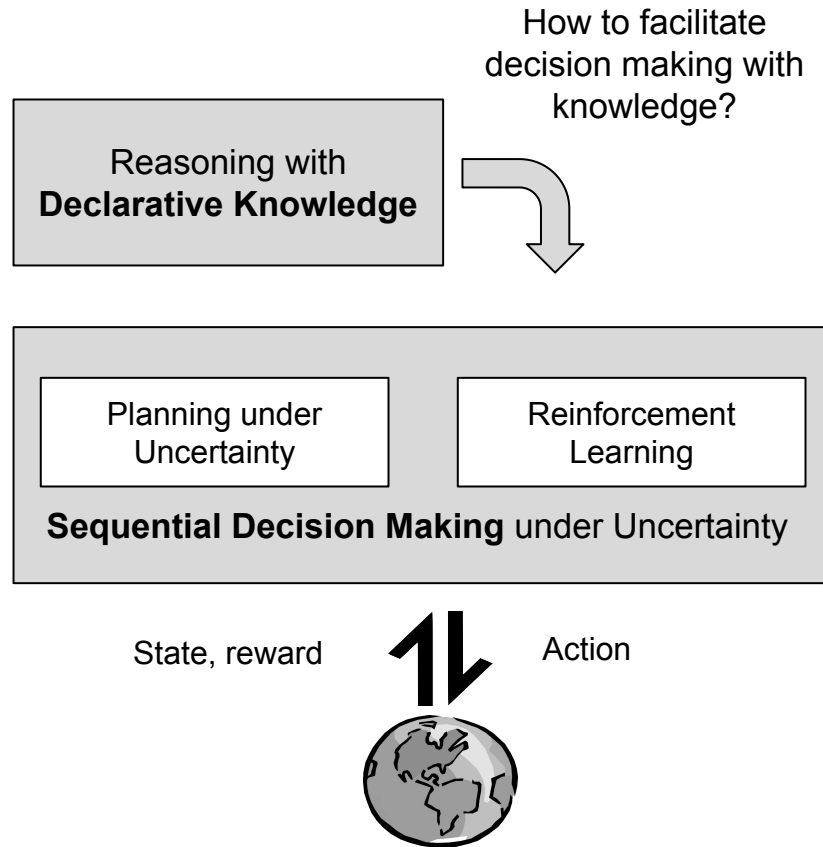
Shiqi Zhang, SUNY Binghamton, Awarded 09-01-2019, Poster #11 (Session 6, April 21)

Challenge

- How to enable robots to leverage declarative knowledge in sequential decision-making methods?

Solution

- Unified representation for reasoning and planning under uncertainty
- Reasoning for state estimation to guide planning and reinforcement learning agents



Scientific Impact

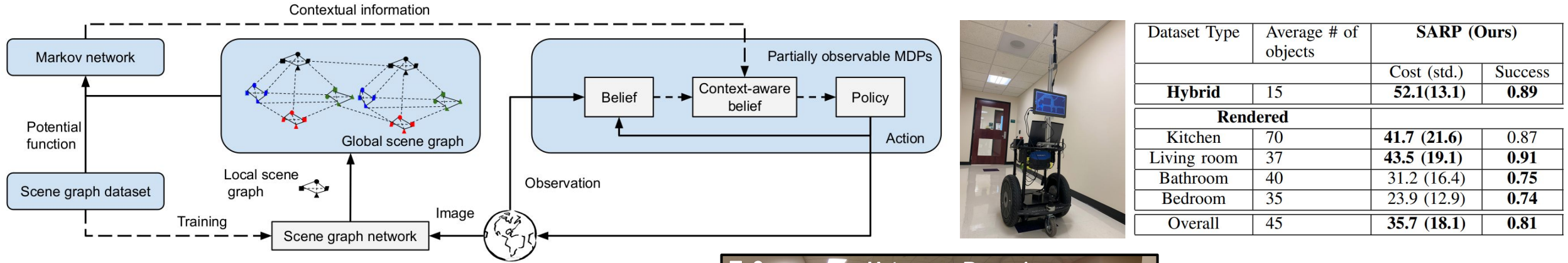
- Bridging the representation gap between knowledge-based reasoning methods, and data-driven sequential decision-making methods

Broader Impact

- AAI'19 [Tutorial](#); IROS'19 [Workshop](#); RSS'21 [Workshop](#)
- 20+ undergraduate students from First-year Research Immersion program;
- Five research papers co-authored by undergraduate students

Reasoning with Scene Graphs for Robot Planning under Partial Observability, Amiri, Chandan, Zhang, ICRA/RA-L 2022

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Dataset Type	Average # of objects	SARP (Ours)	
		Cost (std.)	Success
Hybrid	15	52.1(13.1)	0.89
Rendered			
Kitchen	70	41.7 (21.6)	0.87
Living room	37	43.5 (19.1)	0.91
Bathroom	40	31.2 (16.4)	0.75
Bedroom	35	23.9 (12.9)	0.74
Overall	45	35.7 (18.1)	0.81

- **S**cene **A**nalysis for **R**obot **P**lanning (**SARP**) for robot sequential decision-making
- Uses images from different positions to construct global **scene graphs** to facilitate state estimation
- Enables context-aware, object-centric decision making while avoiding state explosion

