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

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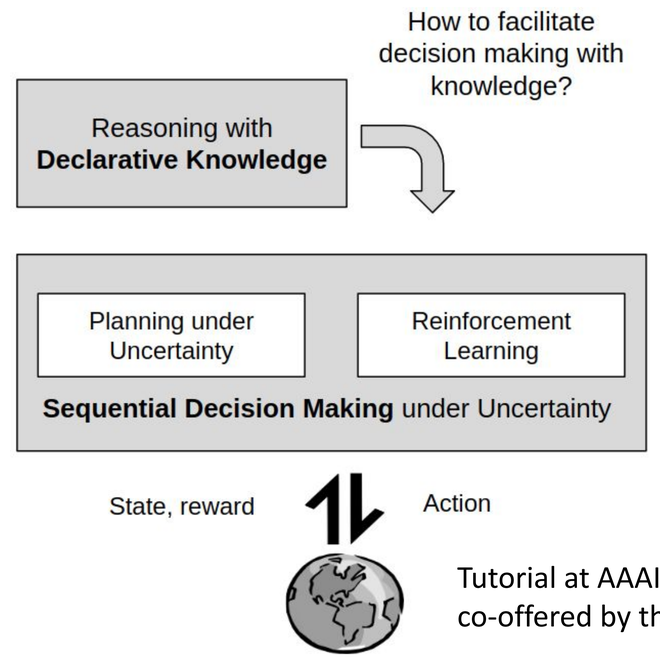
Background: Reasoning with declarative knowledge and sequential decision-making are two key research areas in Robotics and Artificial Intelligence. Both classes of methods reason in the presence of uncertainty. Despite the rich literature in these two areas, researchers have not fully explored their complementary strengths in the robotics.

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

Approach: 1) Unified representation for reasoning and planning under uncertainty, and 2) Reasoning for state estimation to guide planning and reinforcement learning

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

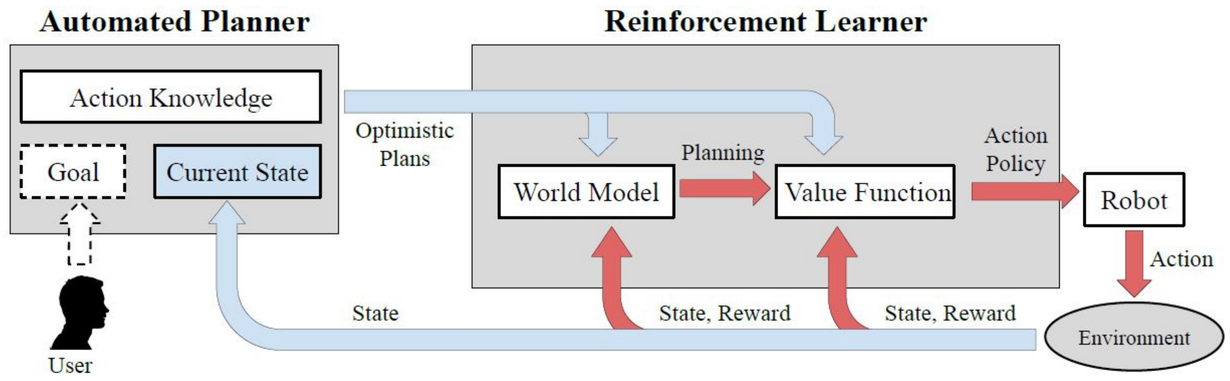


Tutorial at AAAI-19 co-offered by the PI

GDQ: Guiding Robot Exploration in Reinforcement Learning via Automated Planning

Accepted at ICAPS-21 (other papers at ICRA-21, IROS-20, AAAI-20, JAIR-20)

- Automated planner (based on declarative knowledge) used for generating optimistic experience to guide robot off-policy reinforcement learning
- A real robot is able to learn to navigate an indoor office environment in less than 30 trials
- Able to quickly adapt to a new task



Broader Impact: AAAI 2019 Tutorial on Knowledge-based Sequential Decision Making; IROS 2020 Workshop; 10+ undergraduate students from First-year Research Immersion program; 3 research papers with undergraduate students; Spring-21 short course on AI Robotics to Lyceum, a Lifelong-Learning Institute of SUNY Binghamton; Gift (unrestricted) grants from the industry