Knowledge-based Robot Sequential Decision Making under Uncertainty (NSF NRI #1925044)
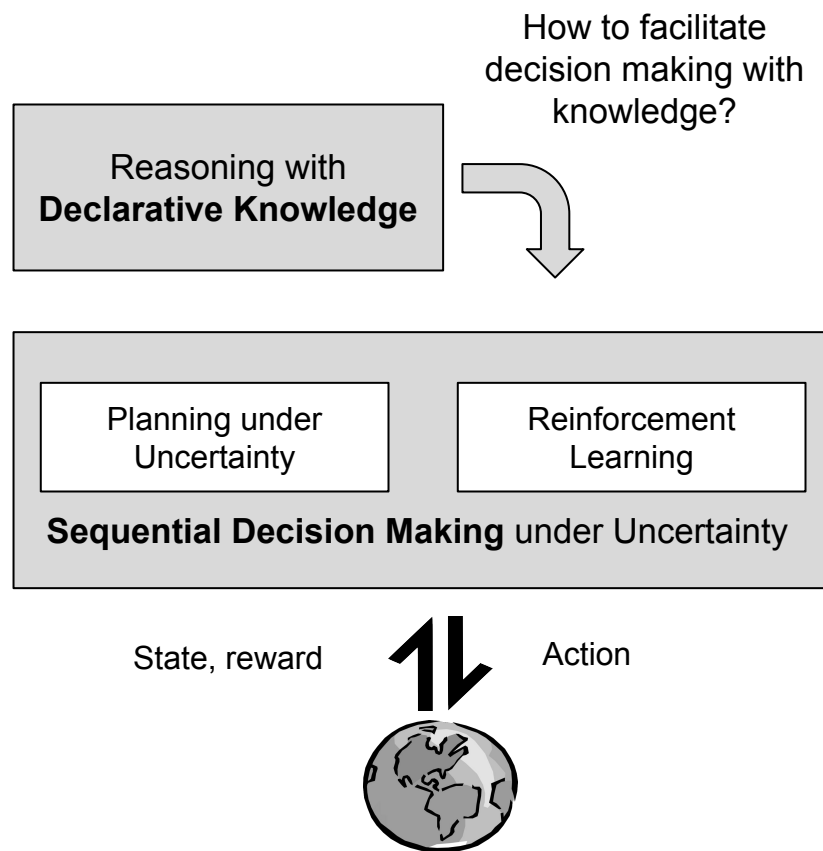
Shiqi Zhang, SUNY Binghamton, Awarded 09-01-2019, Poster #14 (Session 4)

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

- AAAI 2019 Tutorial; IROS 2020 Workshop

- 10+ undergraduate students from First-year Research Immersion program; 3 research papers with undergraduate students

- Gift grants from Ford and OPPO

GDQ: Guiding Robot Exploration in Reinforcement Learning via Automated Planning
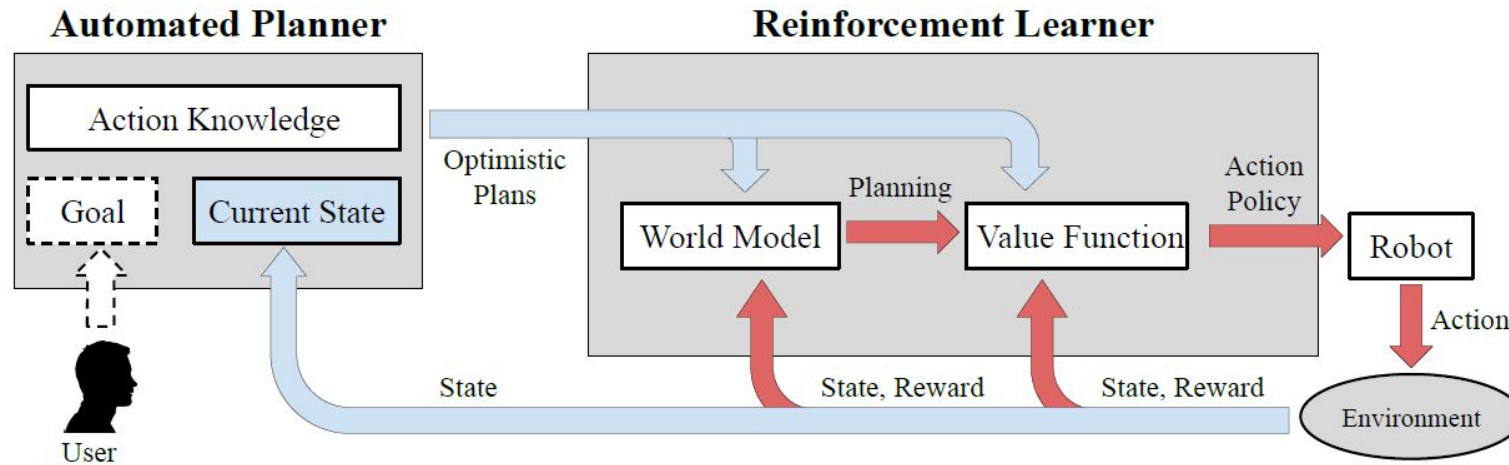
- Automated planner (knowledge-based) used for generating optimistic experience for robot off-policy reinforcement learning

- A real robot learns to navigate an office environment in less than 30 trials

- Performs better than an existing knowledge-based reinforcement learning method (top right)

- Able to quickly adapt to a new task (bottom right)